DRIVERS OF ADOPTION OF ELECTRIC CARS

A comparison between Finland and Norway

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ABSTRACT OF
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Objectives

The main objectives of this study were to find out what actions have been taken by authorities, what are the other affecting factors, and to find out how these actions and factors have affected adoption of electric cars in Finland and Norway and contrast the results. Additionally, one objective was to find out the main factors that reduce people’s intent to acquire electric cars in these two countries.

Summary

A literature review was conducted to examine the different factors affecting electric car adoption globally. From these factors, a thorough analysis of Finnish and Norwegian conditions for electric vehicle adoption was conducted through qualitative desk research, alongside interviews with electric car market experts regarding the current market states of both countries.

Conclusions

The extent to which the current circumstances encourage adoption of electric cars is quite different in the two countries. While both countries discourage combustion engine cars and incentivize electric cars, Norway incentivizes them to a much higher degree, with the most important incentive being complete exemptions from any purchase taxes, as purchase price was found to have the greatest effect on electric vehicle adoption. While Norway seems to have removed any major the main barriers for individuals and companies to adopt electric vehicles, Finland struggles the most with the price of EVs. Most other barriers seem to be very small or negligible compared to high prices.

Key words: electric vehicle, adoption, country comparison, Finland, Norway

Language: English

Grade:

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1. INTRODUCTION

1.1. Background

Climate change and its effects, which are often considered to be caused by pollution, are one of the largest global threats of the current times (World Economic Forum, 2019; WHO, 2019; Cotton-Barratt et al. 2016). Transportation is a major source of pollution and is responsible for 15 percent of global manmade greenhouse gas emissions (Center for Climate and Energy Solutions, 2018) and cars caused over 60 percent of the CO2 emissions that came from transportation in the EU (European Parliament, 2019). Therefore, it is vital for the environment to move over to vehicles powered by alternative power sources, most prominent of which are electric vehicles, or EVs. Both Finland and Norway have recognized the need for alternative fuels and have set up ambitious and somewhat similar goals to make transportation less polluting (Jääskeläinen, 2017; Norwegian Ministry of Transport and Communications, 2016-2017). Despite both countries incentivizing EVs heavily, the number of people who have adopted an EV in Norway eclipses the number of EV adopters of Finland by multiple times (Traficom, 2019; Opplysningsrådet for veitrafikken, n.da). The goal of this study is to examine the reasons for this difference.

The total environmental impact of EVs is a well-researched area with differing results. According to Nordelöf et al. (2015) the results are inconclusive due to the multitude of factors affecting the measurements of the EV's and the comparison vehicles environmental impact: the electricity mix used to power the EVs, the vehicle lifecycles, driving distances, driving environments, and the recycling of battery parts to name a few. Most studies however agree that carbon dioxide emissions from powering EVs is often less than the carbon dioxide emissions from combustion engine cars, and that EV batteries are toxic and bad for the environment, but the extents differ due to the factors affecting measurements. De Souza et al. (2018) mirror this sentiment and calculated that replacing half of Brazil's petrol cars with BEVs would reduce CO2 emissions of transportation by 24 percent at the current electricity mix. Helmers et al. (2015) showed that EVs using the 2013 German electricity mix had about 30 percent less environmental impact during its lifecycle than a traditional combustion engine car. Casals et al. (2016) noted that at the same time as many EU countries would reduce greenhouse gas emissions by using more EVs with their electric mixes at the time, most countries were also working towards cleaner electricity production, and therefore making EVs more environmentally friendly. Un-Noor et al. (2017) also predicted many possibilities for the future of EVs, with improved and new technologies, increased efficiencies and generally better possibilities for EVs.

In the area of marketing, many studies have been done about EVs in general, such as a study done by Cherubini et al. (2015), where they examined the critical success factors in EV marketing. They highlighted four areas of priority to develop by manufacturers and marketers: partnerships among the main players as the most important; proximity of charging points and ease of use; value proposition and product-service bundle price; and advanced navigation systems. To complicate the adoption of EVs further from the point of view of EV manufacturers, Pahurkar and Metha (2017) noted that one version of a car is not sufficient for all customers, and therefore EV manufacturers must build multiple models with differing options. The modern EV industry, which can be considered to have been started by Nissan Leaf and Tesla Model S, is very young at about 10 years old and developing at an astonishing rate. Therefore, many studies done more than a few years ago can be somewhat outdated, including the two aforementioned studies what were done one half or one quarter ago of the industry's current lifetime. The fast development and young age of the industry highlights the need for recent research. In addition, as those with interests in the industry have concentrated on the issues mentioned, research on the recent results is desirable. However, as actions of authorities have been different in different countries, country level research provides the most useful information.

1.2. Research problem

The decision to adopt an EV can be a long and complicated process with multiple factors affecting the final decision. The adoption process has been studied often but as car purchases are affected to a large extent by the circumstances of the specific countries, drawing conclusions from the results of other countries can be problematic. Therefore, direct research of the country or countries examined regarding EV adoption is often required. This study specifically researches the circumstances that have led to the large difference between Finland and Norway in EV adoption rates.

To put the problem into one sentence: Why are there differences between Finland and Norway in adopting electric vehicles?

1.3. Research questions

This thesis aims to answer the following questions.

- To what extent do current circumstances encourage adoption of electric cars in Finland and Norway?
- What are the main barriers for individuals and companies for adopting electric vehicles in Finland and Norway?
- Are the views of EV experts in line with the research, or are there disconnects, dated research or new factors?

1.4. Research objectives

The main research objectives of this study are:

- To find out what actions have been taken by authorities and other factors in both countries, and to find out how these actions and factors have affected commitment to electric cars and contrast the results
- To find out the main factors that reduce people's intent to acquire electric vehicles

1.5. Definitions

Electric vehicles, or EVs as henceforth abbreviated, are vehicles powered by electric motors. While there are many forms of EVs, this thesis will only refer to battery electric vehicles, and of those only passenger cars, as EVs, to keep up with common language meanings and practices. Battery electric vehicles are solely powered by the electricity stored in their batteries and cannot run on any other fuel. Whenever another type of electric vehicle is mentioned, such as a plug-in hybrid electric vehicle (PHEV), they will be referred to by their specific type of vehicle (PHEV), and not as EV, as is common practice.

Hybrid cars are, as their name suggests, powered by two different power sources. The most common hybrid cars by far are powered by both electricity stored in their internal batteries and a combustion engine running on fossil fuel. The batteries of plug-in hybrids can be charged similarly to EV batteries by plugging the car to a compatible electric outlet.

Combustion engine cars are the traditional cars that are the majority in most countries. They are powered by a reaction chain caused by burning fuel within the engine. The energy released from the reaction is converted to movement that powers the systems of the car and turns the wheels. Traditional combustion engine cars use gasoline or diesel as fuel, but some accept alternative fuels, such as biodiesel or ethanol.

Greenhouse gas defined by Mann (2019):

> any gas that has the property of absorbing infrared radiation (net heat energy) emitted from Earth's surface and reradiating it back to Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases.

Value added tax, or henceforth VAT, "is a general consumption tax on the consumption of goods and services. VAT is an indirect tax which is to be paid by the end-consumers." (Valtiovarainministeriö, n.d.)

2. Literature review

2.1. Introduction

The purpose of this literature review is to explore the factors that affect the adoption of and commitment to electric vehicles, or EVs in short. Climate change and environmental concerns are currently more relevant than ever, and actions need to be taken to reduce pollution and dependence on fossil fuels to reduce the future impacts of climate change. Electric vehicles are seen as one solution for reducing the pollution caused by transportation. The current buyer profile and traits which have been found inconclusive, decision affecting factors, incentives and main barriers for adoption will be also examined.

The purpose of this literature review is to discuss what has been studied and discovered about EVs. This research briefly mentions hybrid electric vehicles and alternative fuel vehicles but does not discuss them in depth, and they are an area for future research. Neither does it focus closely on commercial EV users, but mainly on private users.

2.2. Why electric vehicles

One solution for reducing pollution from transportation is to move from combustion engine cars to battery electric vehicles that are powered by electricity from local networks and therefore have the potential to run without producing any greenhouse gases, if the energy production is clean. In addition, an EV using average European electricity is almost 30 percent cleaner over its lifetime than even the most efficient current internal combustion engine vehicle (Hall & Lutsey 2018). Other solutions are hybrid electric vehicles that use traditional fuel in combination with chargable batteries or alternative fuels, such as ethanol. However, while being more practical in short term in most parts of the world, these two solutions do not have the potential for zero emissions usage, unlike EVs, and are therefore not as good as long-term solutions. Another theoretically equally viable transportation solution is fuel cell vehicles, that are powered by hydrogen and are classified as zero emissions vehicles. Unfortunately, only few models are currently for sale and refueling infrastructure would need to be built from zero for fuel cell vehicles to be viable in a larger scale. As EV’s charging infrastructure is very easy to add to existing electricity network, and EVs are already gaining traction, they are the more likely solution for the future.

The current share of EVs of global car fleet is very low, and many countries lack the necessary infrastructure to operate EVs effectively in the current day and in the near future. Many of these countries lacking in infrastructure are still developing countries, but not all developed countries have the existing infrastructure or resources for building it. The EU is considered to be very developed area in general, and even there the current share of electric cars is very low. The size of EU’s passenger car fleet was 268 million (European Automobile Manufacturers Association, 2018) and there were only 0.42 million battery EVs in Europe in 2017, which increased to 0.63 million in 2018 (IEA, 2019). However, the sales of all plug-in electric vehicles, which include plug in and battery EVs, are increasing at an astonishing rate, at 46 to 69 percent per year since 2011 (Virta, 2019) and one optimistic scenario predicts that by 2030 there will be 145 million passenger EVs globally (IEA, 2019).

To conclude, climate change is a major threat globally, and EVs are one solution to reducing pollution from transportation and mitigating climate change. It is the favorite, compared to other alternatives due to its potential for zero emissions usage and relatively easy to build infrastructure. There are few EVs used currently, but the amount of EVs is increasing very rapidly.

2.3. Buyer profile

Before analyzing differences between Norway and Finland in EV adoption, it must be understood who the current people are that adopt EVs and how the decision of adoption is made. After establishing this background information, it is possible to make conclusion based on statistics on whether the differences are caused by differences in country's populace and environment or by actions of authorities. The current profile of average buyers of EVs can be used to compare populaces or target certain segments with more relevant incentives and advertisements.

According to Moons and De Pelsmacker (2012) gender plays a role in intention to use EVs, and women's intention is much higher than men's as in general women are also more concerned about the environment. Similarly, Simsekoglu (2018) found that being female is the greatest demographic predictor for buying an EV. Another study done by Simsekoglu and Nayum (2019) found the same. However, while gender predicts the chance of the individual adopting an EV instead of a conventional combustion engine car, this is not reflected in the share of female EV drivers and owners as the majority of EV drivers and owners are male (Sovacool et al. 2018; Simsekoglu 2018; Nayum et al. 2016). In essence, the average woman is more likely to adopt an EV than the average man when acquiring a car, but as men are more likely to acquire a car, especially in the Nordics (Sovacool et al. 2018), more men than women own an EV. Unfortunately, these studies likely suffer from a slight sampling bias, as men were much likelier to answer surveys about EVs due to men often being more interested about cars. Because of men being more likely to purchase a car and therefore an EV, it would be reasonable that the effort put into increasing EV adoption should focus slightly more on men for increased results.

Examining EV buyers through education and income perspective reveals that most EV owners have a higher income and a higher education (Sovacool et al. 2018; Peters et al. 2018; Nayum et al. 2016). Curiously, Simsekoglu (2018) highlighted that in Norway, having a middle-income decreased the probability of owning an EV instead of a conventional car. This is somewhat contradicted by a later study of Simsekoglu and Nayum (2019) where being in said income category received the only positive beta value of all income categories in a table about predictors of intention to buy an EV. The value of 0.01 however is insignificant and predictions of intention do not directly transfer to current statistics within the real world. It is not surprising that high income and highly educated people own more EVs as they are more likely to afford them. As there are not many EVs on the roads, there are not also too many available on the cheaper second-hand markets that lower income individuals use more.

The strength of an individual's "green values" is the most prevalent common denominator when looking at the owners and predicting intention to buy (Anfinsen et al. 2019; Brase 2018; Barbarossa et al. 2015; Rolim et al. 2014). These green values include considering oneself an environmentally good consumer, worrying about climate or pollution and generally wishing to reduce the harm caused to environment. Orlov and Kallbekken (2019) did not find concern for environment to be a driver of EV adoption, but that being open to trying new technology and wish to reduce energy consumption were better indicators. This suggests that the green values cannot be thought as a single metric but are instead divided into subcategories. Overall, green values are very closely tied to EV adoption.

Other factors in determining the most likely person to adopt an EV include age, living area and attitude toward EVs. In the study of Nayum et al. (2016) in Norway, the mean age of an EV owner was slightly over 45 and significantly below the average age of an average car owner. In the Nordics however, Sovacool et al. (2018) illustrated that people aged 25-44 own more EVs and in Norway over a third of surveyed EV owners were between 36 and 45 (Bjerkan et al. 2016). Jansson et al. (2017) provide counterevidence with their study in Sweden, where the mean age was 56.8, or 1.8 years older than the sample mean. This study has more credence as sampling quality was emphasized and correspondent with car owner data of Sweden, as opposed to the three studies done via online surveys, but the differences can also be caused by differences in countries or because mean calculations are not always good indicators of distributions. Jansson et al. (2017) also concluded that EV adopters live near or in larger cities in addition to having higher income and education. Mersky et al. (2016) also found a connection between EV sales and presence of large cities while Langbroek et al. (2016) did not find a connection between EV-adoption and home distance from a city center in Sweden. Mersky et al. (2016) used actual sales data in Norway and noted that low absolute sales numbers for many of the municipalities might have not possibly offered reliable data on regional level, as opposed to Langbroek et al (2016), who used a survey where a normal and an EV were compared. The difference could be caused by Norway's incentive scheme that offers more benefits to city driving. The effect of distance to a city on adoption is still unclear. According to Moons and De Pelsmacker (2012) emotions toward EVs is the most influential factor in predicting adoption, which comes as no surprise as cars are an expensive purchase that often take significant consideration.

To summarize, the person most likely to intend to adopt an EV when acquiring a car is a woman with strong green values, high education and income and feels positively about EVs. This is very similar to the demographic that has adopted the most EVs in total, with the key difference being the gender of the owner. However, EV owners are a very heterogenous group (Anfinsen et al. 2019; Sovacool et al. 2018) and Sierzchula et al. 2014 proposed that socio-demographic variables are not good at predicting adoption levels. Therefore, these variables for current and possible adopters are not to be considered as a cornerstone in research, marketing and policy development, but they may provide assistance.

2.4. Decision making and consumer perceptions

Purchase price is an important factor in increasing adoption, as a study in Sweden by Langbroek et al. (2016) noted. The study found significant price sensitivity in people in all stages of adoption, especially among those who have not yet considered adopting an EV. Price sensitivity reduces the further the person is in the adoption phase up to by a quarter for those who already have adopted an EV, suggesting that competitive prices are important to get people to consider EVs. MarketLine (2019) also reported new car buyers being very price sensitive. The importance of price is further highlighted by results showing that in Norway, 80 percent of EV owners were of the opinion that exemptions from all EV purchase taxes were critical for the purchase of their EV (Bjerkan et al. 2016). The statistic presented in this study however should be taken with a grain of salt by the readers, as it only considered the owners' specific purchases and not EVs in general. It is quite safe to assume that the lack of taxes allowed the owners to purchase an electric vehicle with better characteristics than a traditional vehicle with comparable price after taxes, and it is often expected for humans to maximize their investment. Furthermore, on the subject of price sensitivity, Larson et al. 2014 stated that consumers were not willing to pay substantial premiums for EVs, strengthening the claim of price being an important factor for EV adoption. In essence, EV prices are very important for adoption.

Whether the money saved in the running costs of EV, in forms of lower fuel costs, reduced maintenance and exemptions granted by authorities, is factored into the decision to adopt an EVs was problematic as many consumers, especially in the past, did not consider the lifetime costs of EVs (Larson et al. 2014). However, Egbue and Long (2012) noted a relationship with increased gasoline prices and EV adoption. When Egbue and Long (2012) asked to rank the appealing attributes of EVs in the US, reduced maintenance and fuel use won over comfort, style and environmental attributes. Also, luckily, information seems to have spread and Mattar et al. (2018) noted that the top priority for purchasing an EV in the UK was lower running costs, even before lower emissions. Figenbaum et al. (2014) findings show 38% of EV owners placing significance on operating costs. While Mattar's et al. (2018) research had a very low sample size of 60, it indicates that running costs are now an important factor when deciding about EV adoption. Lower running costs will likely play a much larger role in the future if fuel prices increase due to changing market conditions or actions of authorities, while already playing a large role.

Peer pressure and how people think others react to their choice of car purchase is somewhat significant in predicting EV adoption according to Moons and De Pelsmacker (2012). To support this, Jansson et al. (2017) noted that EV owners were subject to higher levels of social influence in "green matters" by others than conventional car owners. Curiously, EV owners were ranked the lowest on opinion seeking and highest in opinion leadership suggesting that the owners did not adopt EVs just because others had, but because they thought that it gives a positive signal about them.

When the adoption of EV is considered by people, it is important to know what advantages electric vehicles have and more importantly how relevant they are. The economic benefits that EV ownership grants is by far the most important advantage, as 85 to 95 percent of private users feel the cost to be an advantage in Belgium and Lisbon (Rolim et al. 2014; Lebeau et al. 2013). Being environmentally friendly was considered to be an advantage by many, but how many was found to be differing. Lebeau et al. (2013) reported in Belgium that over 90 percent considered it some kind of an advantage while Rolim et al. (2014) reported in Lisbon that 46 percent considered environmental friendliness to be an advantage. The difference between the studies is probably to an extent caused by different societal values in Belgium and Portugal, but to a large extent also by the difference in methods. Rolim et al. (2014) used open ended interviews and the answers were possibly subject to the plethora of errors or biases often found in open ended interviews, but also highlighted what is on the minds of owners. On the contrary, Lebeau et al. (2013) used surveys where participants were asked to rate how important different advantages were and reminding participants of factors they might not have brought up otherwise. Other major advantages included driving comfort at about 85 and 77 percent (Lebeau et al. 2013; Rolim et al. 2014), and ability to charge at home at about 90 percent (Lebeau et al. 2013). As the largest advantages of EVs currently are economic, environmental and driving comfort, it can be reasoned once again that increasing relevance of green values in a population and spreading information about EVs drives adoption further, if offering even better economic benefits is not considered.

2.5. Incentives

Incentives are a very effective and an important tool for increasing EV adoption, especially in the Nordic countries (Kester et al. 2018; Langbroek Franklin & Susilo 2016; Mersky et al. 2016; Sierzchula et al. 2014). There are many different incentives and ways to categorize incentives, but the two rough categories are purchase-based incentives, such as exemptions from purchase taxes, and use-based incentives (Langbroek et al. 2016), which could be further divided into cost incentives, such as exemptions from car owning tax or road tolls, convenience incentives, such as access to bus lane, and other incentives. Unsurprisingly, different incentives affect adoption to different degrees and consumers place different values on them (Kester et al. 2018; Langbroek Franklin & Susilo 2016; Mersky et al. 2016; Bjerkan et al. 2016).

As previously mentioned, over 80 percent of EV owners surveyed in Norway felt that exemption from all purchase taxes was critical for their purchase (Bjerkan et al. 2016). Also, as previously mentioned, the study only considered the owners' specific purchases and not EVs in general but is still a good representation of effectiveness purchase-based incentives. To support the notion of purchase-based incentives being vital, many experts favored reducing purchase price through reduced taxation (Kester et al. 2018) and research in China found license fee exemption to be important (Wang et al. 2017). The importance of purchase-based incentives ties extremely closely to the price sensitivity of consumers and price being a major factor in decision making regarding EV adoption. As expected, purchase-based incentives have the greatest total effect of subsidies on adoption, albeit at a high price for authorities.

Owning and running cost reduction incentives are less effective, but still notable. In Norway, slightly less than half considered exemptions from road tolls and vehicle owning tax reductions critical for purchase (Bjerkan et al. 2016), and Kester et al. (2018) stressed local variable benefits, such as free parking, incentives to build charging stations and access to bus lanes as the most important incentives after price reductions. Langbroek et al. (2016), Bjerkan et al. (2016) and Sierzchula et al. (2014) also all found incentivizing charging stations, as other incentive, to be one of the most important subsidies. In Norway, when counting exemption from VAT and car tax separately, 65% of EV owners would have bought an EV if only 3 incentives or less existed out of the current 7 (Bjerkan et al. 2016), suggesting that increasing the number of incentives offers diminishing returns. Bjerkan et al. (2016) however only studied EV owners and not the general consumers, limiting the usefulness of the specific information on number of incentives. In addition, keeping current incentives and authorities giving clear long-term plans about incentives is important in increasing adoption and removing uncertainty (Kester et al. 2018; Langbroek et al. 2016). Is brief, other incentives are still useful, and authorities showing clear, long term signals is vital.

Another way to increase adoption of EVs is to do the opposite to combustion engine cars, as in disincentivize through higher fuel prices, purchase taxes, possible road tolls and ownership taxes, making EVs a more lucrative choice. However, this method may backfire if the general population cannot afford new EVs and the supply of used EVs is limited.

To summarize, incentives for EVs, especially in the Nordics, play a large role in increasing adoption, and the most effective incentives are purchase-based, such as reducing purchase taxes. When paired with another use-based incentive and incentivizing availability of charging stations, a very effective package is made that tremendously increases adoption rates.

2.6. Main perceived barriers to adoption

Battery range sufficiency is often a concern with EVs for consumers, as the charging takes considerably longer than filling up the tank of a conventional car, and this worry is also prevalent in Egbue's and Long's (2012) research in the US, where one third named battery range as their biggest concern about EVs. This is supported by Lebeau et al. (2013), who reported that limited range was the second largest disadvantage of EVs, slightly behind high purchase price, even in Belgium, where general trips are often shorter than in other countries. Both studies found the next two largest concerns to be high price and limited available charging infrastructure. Lebeau et al. (2013) also found price, range and charging availability to be large barriers, as did Melliger, van Vliet and Liimatainen (2018). How statistically sufficient EV ranges are and what impact charging infrastructure has on adoption will be examined later in more depth. However, it should already be noted that even in the US, where people drive over twice as much per capita as in the Nordics (International Comparisons: Transportation Statistics by Country 2016), 21 percent of vehicles had never driven more than 240 kilometers in a day (Pearre et al. 2011). There are currently 20 EVs with a range equal to or higher than 240 kilometers (Wikipedia Contributors, 2019), which could lead to diminishing range anxiety as information about these EVs spreads. Currently range anxiety is very prevalent among consumers and cannot be ignored.

As previously mentioned, worries about EV range are a concern to consumers, it is important to know if they are founded in reality and whether the possible shortcomings can be fixed. In the Nordics the range of current EVs is more than enough for everyday driving (Melliger et al. 2018), even for over 90 percent of population (LIU et al. 2015), as most EVs have over 200-kilometers of range. Unfortunately, LIU et al. (2015) did not research the longest trips Nordic citizens take, which many possible adopters consider to be vital to be able to cover in their car. And as noted, even in the US 21 percent of vehicles had never driven over the common range of current EVs in a day (Pearre et al. 2011). This can imply that even in the Nordics at least 20 percent of population could adopt an EV with no impairments to driving, if they have relatively easy access to charging. Melliger, van Vliet and Liimatainen (2018) ran simulations on sufficiency of EV range with recharging in Finland and found out that currently over 85 percent of trips could be covered with baseline EVs and charging station distribution that is at homes, workplaces and leisure activities, and 98 percent is possible to reach with current long-range EVs and by building or improving charging infrastructure at relevant locations. In reality these numbers would be higher than reported, as the simulations did not plan ahead and around keeping the EV at sufficient battery levels, unlike human drivers would. Additionally, charging time is decreasing and Teslas, the market leading cars in battery technology, can charge over 240 kilometers of its over 530-kilometer range in a bit over 10 minutes (Electrek 2019). Many current EVs charge at least 30 kilometers in 10 minutes at a basic 50 kW fast charging stations (Maric 2019), and many 100-15 kW stations are available that charge compatible EVs to 80% battery charge in 20-40 minutes (EV Charging connectors - Electric car charging speeds 2019). These results lend credence to EVs being suitable for the vast majority of drivers if they have easy access to charging.

Reliability is also found to concern consumers and act as a barrier to adoption (Larson et al. 2014; Egbue & Long 2012). Reliability concerns may seem odd, as EVs have less moving and wearable parts than traditional car engines have but are often loaded with new technologies and gadgets that may be prone to breaking. In addition, the current brands that manufacture EVs are not known among the general public to be industry leading when it comes to reliability, and battery life is a concern.

To conclude, the perceived barriers for adoption appear to be range anxiety and reliability. Reliability is not only a perceived barrier, but likely has basis in real world. Range anxiety is unfounded for most individuals, if access to charging stations is easy. In addition, faster charge times and building more charging stations should reduce range anxiety.

2.7. Conceptual framework

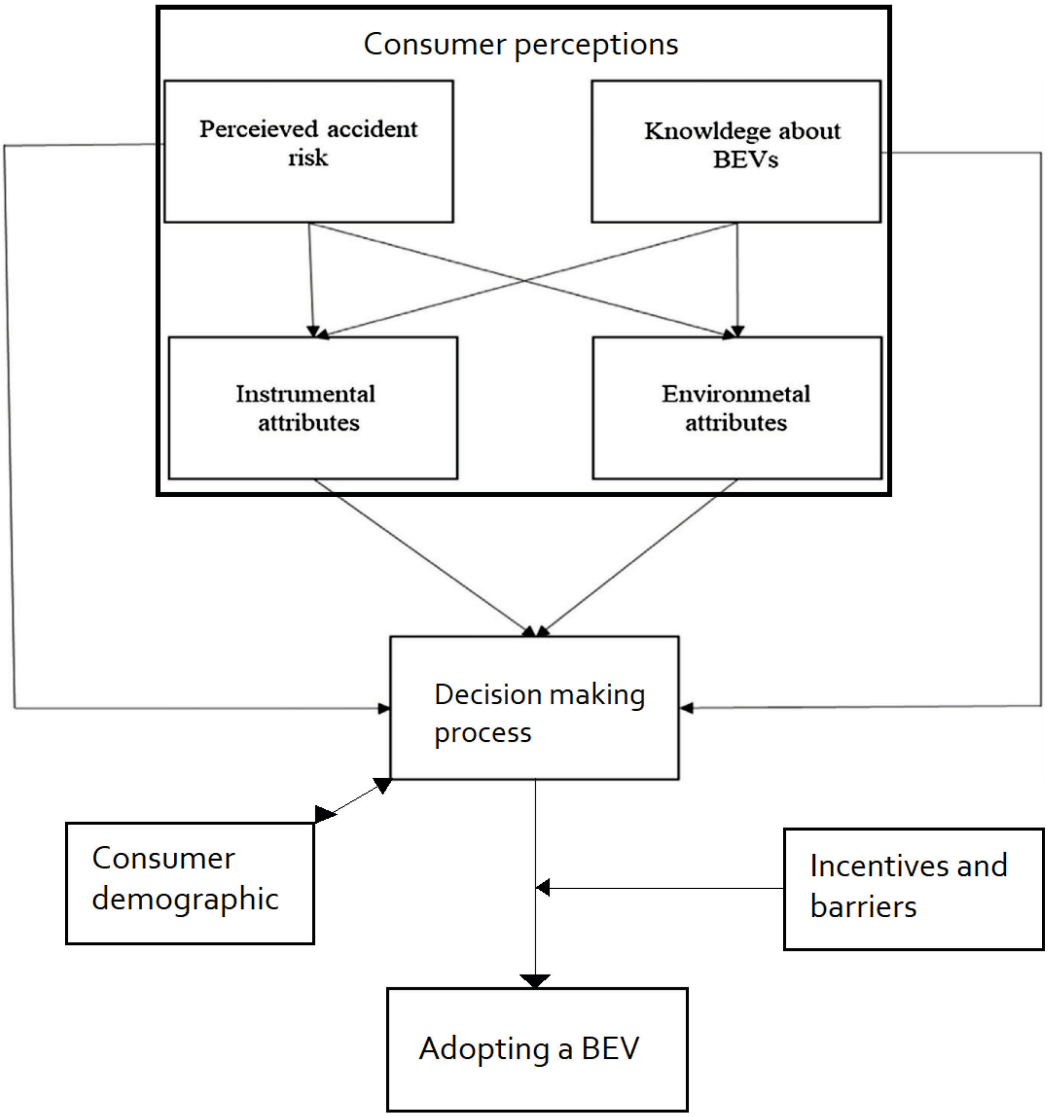

Figure 1: Conceptual framework, adapted from Simsekoglu & Nayum (2019)

The conceptual framework presented in Figure 1 is a modified version of Simsekoglu's and Nayum's (2019) "Hypothesized mediation model showing the process underlying the relationships between perceived accident risk, knowledge, perceived car attributes and the intention to buy a BEV" with crucial aspects after the intention to buy added to give a fuller picture of the individuals process of potentially adopting an EV and the factors affecting it. The "Intention to buy a BEV" was replaced with "Decision making process" that has a relationship with “Consumer demographic”. The decision-making process potentially leads to “Adopting a BEV”, after being affected by “Incentives and barriers”. The original four factors that affected intention to buy have been clumped together into consumer perceptions. This model includes many of the discussed factors and puts them into perspective.

2.8. Conclusions

This research indicates that the current buyers of EVs are a very heterogenous group, with strong “green values” being the largest common trait. Research is contradicting regarding the effect of age, income, education and distance to a city on predicting adoption. Oddly enough, while the average woman is more likely to adopt and own an EV as their vehicle than an average man, the average EV is more likely owned by a man. Prices of EVs have a large impact on adoption, and similarly purchase-based incentives have been found to be the most effective incentives for increasing adoption rates. Incentives have overall been found to be very effective, and despite consumers having anxiety over range, EVs are sufficient for the majority people if they have easy access to charging. When comparing Norway and Finland, the notable difference is in wealth.

For increasing EV adoption rates, incentives for purchase seem to be the likely first choice, followed by strengthening the green values of the population, through some form of education and changing public perceptions, and building charging stations. The range anxiety is likely to reduce significantly as public knowledge increases and technology goes forward, and more manufacturers increase their vehicles’ ranges.

More research is needed on how different incentives would affect theoretical adoption in countries that do not have large existing incentive schemes, unlike Norway where the majority of incentive research originates from. Also comparing demographic EV owner data between many countries would be useful for gaining more insight.

3. METHODOLOGY

This research incorporates both primary and secondary data. This section explains why the two qualitative methods, desk research and interviews, were chosen and how they relate to the purpose of this study.

3.1. Qualitative desk research

As the purpose of this study is to find out to what extent current circumstances encourage adoption of EVs, and the reasons for individuals to adopt or to not adopt EVs in Norway and Finland, qualitative desk research was chosen as the main research method. It can provide the most comprehensive overview of the current situation in Norway and Finland, regarding statistics, incentives, populations and environments. The research side of this secondary research was discussed in the literature review and the analysis and findings section discusses the two countries that are compared. From the overview, links can be drawn to the theory, and the reasons for differences can be discussed. The additional country data was sourced mainly from governmental organizations, and where not from official bodies, from different companies and foundations dedicated to the matter that is discussed.

3.2. Data collection for interviews and sample

EV industry experts, such as car salesmen, infrastructure builders and strategy managers of car companies can offer unique and very in-depth information and views on the past, current and future of the EV markets. Therefore, interviewing them offers great insight that can be used in many ways. The interviews in this thesis were used to see if the opinions of experts go hand-in hand with theory, to find new factors that affect adoption in Finland and Norway and to give estimates on the past and the future of EV markets in the two countries. Interview data was collected mainly through phone calls, and in one case through e-mail. Phone calls and the e-mail were chosen mainly due to convenience and the increased chance of experts responding. While face-to-face conversations in person or online would have had many advantages over phone calls, organizing them would have likely reduced responses as the experts led busy lives all over Finland and Norway. The advantage of phone calls was that the experts only had to reserve some time to talk over the phone and not worry about added distractions.

Finding experts to interview was done through two vectors. The first, less effective, method was interview requests through e-mails. These request receivers were found through employee lists of prominent car dealerships in Finland and Norway and led to one phone interview and one e-mail interview. The second method was through convenience and snowball sampling beginning with a single company contact. An interview over the phone was arranged, and after the interview more contacts were requested. The contacts were called, and new phone interviews were arranged, and the cycle repeated. This method resulted in four interviews, with average length about half an hour. Not all possible contacts were interviewed as a result of new information per interview significantly diminishing in addition to time constraints. The interviews were recorded with the permission of the interviewees.

In the end six interviews took place. All but one were in Finnish, and the last in English. The experts fell into three rough categories: salespeople, strategists of companies providing EVs and charging infrastructure providers. Only one expert is Norwegian, and the rest were Finnish. However, at least three of the Finnish experts had very extensive experience of operating in the Norwegian EV market. More details about the interviewees can be found below in Table 1:

Interview	Date of interview	Duration	Media	Language (Nationality)	Job category of interviewee	Country experience
#1	Jan 9th, 2020	12 min	Phone call	English (Norwegian)	Sales	Norway
#2	Feb 5th, 2020	37 min	Phone call	Finnish	Strategy	Finland
#3	Feb 13th, 2020	21 min	Phone call	Finnish	Startegy	Finland
#4	Feb 24th, 2020	16 min	Phone call	Finnish	Infrastructure	Both
#5	Feb 26th, 2020	28 min	Phone call	Finnish	Infrastructure	Both
#6	Oct 30th, 2019	120 words	E-mail	Finnish	Sales	Finland

Table 1: Interview and interviewee information

3.3. Interview structure

The interviews were semi-structured and conducted in a somewhat informal setting. Two different question sets were created, as it became evident halfway through that the first set of questions was unsuitable for all experts. Both sets are relatively similar, had five questions in total and shared two questions. The two common questions related to factors limiting and improving adoption, and the importance of technology and incentives. The first set was aimed towards the EV sellers and strategists, and therefore touched upon customer profiles, actions of the company to sell more EVs and business shares. For the infrastructure providers the questions were broader and were about comparing country specific EV markets and general attitudes. For full questions in English, see Appendix 1. In addition to the five main questions, more interview specific questions regarding details were asked where deemed useful. The answers were used to formulate the largest factors affecting EV adoption. For confidentiality reasons the full transcripts are not given. They may be requested by contacting Otso Oksanen at otso.98@hotmail.com.

4. ANALYSIS AND FINDINGS

To analyze how the theories and concepts in the literature review can affect the differences between Norway and Finland, a comprehensive picture of relevant information in the two countries must also be established.

4.1. Goals of Finland and Norway regarding EV adoption

To understand why EV adoption differs between Norway and Finland, the differences must first be recognized in current car statistics, goals of authorities, policy differences and in other relevant areas, such as in fuel prices and environment.

Both countries are committed to European Union’s goal of reducing GHG emissions at least 40% by 2030 compared to emissions of 1990 (European Council, 2014), Finland by virtue of being an EU member state and Norway through treaties with the EU (European Commission, 2019). Both countries have recognized massive pollution caused by the transport sector, and in 2016, the Norwegian transport sector was responsible for about 60 percent of Norwegian greenhouse gas emissions outside of the EU Emissions Trading System, or ETS, (Norwegian Ministry of Transport and Communications, 2016-2017), while in Finland the transport sector accounted for nearly 40 percent of non ETS emissions (Statistics Finland, 2019). As the pressure to reduce emissions increases, and transportation is a relatively easy sector to target, both countries have put plans into place to reduce emissions generated by cars.

Norway has an ambitious plan set by the Norwegian Ministry of Transport and Communications:

> In Norway, purchase of zero-emission cars should be more economically favourable than purchase of conventional cars. The Government has established targets for new zero-emission vehicles. All new passenger cars and light vans sold in 2025 shall be zero-emission vehicles. All new urban buses sold in 2025 shall be zero emitters or use biogas. By 2030, all new heavy duty vehicles, 75 per cent of new long distance coaches and 50 per cent of new trucks shall be zero emission vehicles. Furthermore, the distribution of freight in the largest urban centers shall have almost zero emissions by 2030. (Norwegian Ministry of Transport and Communications, 2016-2017: 30)

Finland set up two targets, the shorter term being lower than Norway’s and the long-term targets much harder, even if not too ambitious goals for itself. Instead of targeting only new car sales, Finland has decided to target total car fleet composition, which is much harder and likely requires politically unfavorable discouraging of already existing combustion cars. Finland however has set a longer timeframe for the fleet changes, along the portion of new car sales, as stated by the Ministry of Transport and Communications:

> Finland’s target for vehicles using alternative fuels is that all new vehicles sold in Finland are compatible with alternative fuels already in 2030. Vehicles that can be powered by either electricity, hydrogen, natural gas/biogas and/or liquid biofuels, also

in high concentrations, will be included in the target. The target for 2025 is that 50% of new cars and vans could be powered by an alternative fuel, and the goal for 2020 is a 20% share of these vehicles. The target set for heavy-duty vehicles is that 60% of new trucks and buses would be compatible with an alternative fuel by 2025, with a 40% share already in 2020. (Jääskeläinen, 2017: 3)

Finland’s national target for road transport in 2050 is near-zero emissions. The power source for cars and vans would either be electricity and hydrogen produced with renewable (or emission-free) raw materials, or different biofuels (liquid biofuels and biogas). Their share in the total energy consumption of road transport would approach 100%. In 2030, the share of alternative fuels in road transport energy consumption would be 40% as minimum. In 2020, this share will be 20% (including double credits for biofuels). (Jääskeläinen, 2017: 39)

Figure 1 on the next page shows how well Finland and Norway were doing in relation to the previously mentioned goals, as well as gives more statistics about the car fleets of the respective countries.

Cars in traffic by driving power, 2018

Mainland Finland*		
Total	2 696 334	100,00 %
Electricity	2 404	0,09 %
Petrol	1 920 510	71,23 %
Diesel	750 603	27,84 %
Plug-in hybrid	13 095	0,49 %

Traficom (2019)

Norway		
Total	2 750 856	100,00 %
Electricity	195 351	7,10 %
Petrol	1 075 179	39,09 %
Diesel	1 290 442	46,91 %
Other fuel**	189 650	6,89 %

Statistics Norway (2019)

New car registrations by driving power, 2019

Total registrations	114 202	100,0 %
Electric	1 897	1,7 %
Hybrid	5 967	5,2 %
Other***	106 338	93,1 %

Traficom (2019)

Total registrations	142 381	100,0 %
Electric	60 316	42,4 %
Hybrid	36 842	25,9 %
Other***	45 223	31,8 %

Opplysningsrådet for veitrafikken (n.db)

New car registrations by driving power, 2018

Total registrations	120 505	100,0 %
Electric	776	0,6 %
Hybrid	4 932	4,1 %
Other***	114 797	95,3 %

Traficom (2019)

Total registrations	147 929	100,0 %
Electric	46 092	31,2 %
Hybrid	42 869	29,0 %
Other***	58 968	39,9 %

Opplysningsrådet for veitrafikken (n.da)

Average age of passenger cars, 2018

Years	12,2

Autoalan tiedotuskeskus (2020)

Years	10,5

Autoalan tiedotuskeskus (2020)

***Åland not included**
****Mainly, but not limited to, hybrid cars**
*****Cars other than electric or hybrid cars, such as diesel cars**

Figure 1: Passenger/Private cars in traffic, new registrations and average age of cars in Finland and Norway (adapted from Traficom (2019), Opplysningsrådet for veitrafikken (n.da), Opplysningsrådet for veitrafikken (n.db) and Autoalan tiedotuskeskus (2020))

As the above tables in Figure 1 show, despite the large growth of EV sales, they only make up together with hybrid vehicles a small fraction of the total car fleets. In Norway, the share of EVs and hybrids in 2018 was notable, unlike in Finland where the shares were abysmal at a bit over half a percent of all cars. However, the growth rates in sales for EVs were very large. At the current pace of Norway, the goal of all new passenger cars sold in 2025 being zero emissions seems realistic given current growth rates, and very likely if EVs are encouraged more or traditional engines discouraged further. The lower average age of cars means that the total car fleet is also updated faster, promising a faster increase in share of EVs in the total fleet.

In Finland the goal of 20 percent of new vehicles being powered by alternative fuel by 2020 will not be achieved through EVs without extreme actions or events. Instead, Finland has opted to focus more on biofuels, and in 2019 over 21 percent of new vehicles registered were able to run on some kind of biofuel, for example on biodiesel or natural gas (Traficom 2019). Ironically enough, this share fell from 2018, where the same share was 25 percent, from where the sale of diesel cars plummeted by nearly a quarter, as diesel cars are falling out of favor. In the light of these figures, it can be concluded that Finland has reached its 2020 sales goal already, although in a slightly disingenuous way. The cars are compatible with alternative fuels, but the availability of said fuel, when not mixed with traditional fuels, is much smaller than that of traditional fuels that can be used to run the same car. The 2030 goal of all new cars being compatible with alternative fuels seems impossible at the current rate, as 70 percent in 2018 and 72 percent in 2019 of new cars registered were powered by petrol (Traficom 2019) and current petrol vehicles are unable to run on pure alternative fuels. In addition, due to the high average age of cars and current new car statistics, the 2050 goal of near zero-emissions road transport seems difficult, but it is not wise to forecast 30 years into the future with such fast-moving technology and environmental concern. Anything can happen, and many new policies can be written in 30 years.

In summary, it is very likely that Norway reaches its goal of all new vehicles having zero emissions at the current rate. Finland, however, seems unlikely to reach its long-term target of zero emission car fleet by 2050 at the current rate, and short term targets for compatibility with alternative fuels are somewhat meaningless, as alternative fuels are not favored over the compatible traditional fuels that cause pollution.

4.2. Finnish and Norwegian EV incentives and car taxation

The next sections delve deeper into the taxation and incentive schemes for new cars, but one must not forget that most drivers bought their car used. In Finland and in 2017, 4.2 percent of the car fleet was registered as new that year at the average price of 34 000 euros, while almost 25 percent of the fleet was reregistered as used cars with new owners at the average price of 6 800€ (Autoalan Tiedotuskeskus, 2019a). This suggests that the used vehicle markets are the key for widescale adoption for EVs in Finland. Unfortunately, as EVs are a such new technology, their availability on the secondhand markets is severely limited, especially in Finland. For context, the average age of Finnish cars is over twelve years, while the first two widespread EVs, Tesla Model S and Nissan Leaf, first started production eight and ten years ago (Nissan Global Newsroom, 2019; Tesla, 2012). In this light, for EVs to become commonplace, they first have to gain standing in the new car markets, which Norway has succeeded in.

The way in which Finland encourages EV and alternative fuel vehicle adoption is multifaceted and somewhat complicated. The simplest part of Finland's efforts is a direct 2 000€ purchase subsidy if the car is fully electric and costs less than 50 000€ including all taxes, and is extended to leasing, if the lease duration is over three years (Traficom n.d.). The Finnish government has allocated 6 million euros per year for these purchase subsidies, or for 3000 new EVs per year, but has not spent all of said money. The second way for Finland is through car taxation, which will be covered later. Additionally, Finland has heavily built and incentivized charging stations (Balzhäuser 2019) and taxes heavily on diesel and petrol. As of 2019, motor gasoline has been taxed 0.7025€ per liter and diesel 0.5302€ per liter (Tax Administration, 2019a), and VAT of 24 percent is added to the after-tax price. In 2020 the price of gasoline has fluctuated between 1.564 and 1.492 euros per liter and diesel between 1.465 and 1.372 euros per liter (mylpg.eu, n.d.). In short, in Finland around 70 percent of what the consumer pays for gasoline goes to VAT and fuel taxes, and over 60 percent of diesel price goes to said taxes.

Finnish car taxation schemes have inbuilt benefits for low emissions vehicles. There are three ways in which Finland taxes cars: the car tax, for buying a car; the vehicle tax, for owning a car; and car benefit tax, for an individual to pay taxes for their company car. All three taxes are made from multiple factors and benefit differently from low emissions. Car tax is the simplest of the three and is paid when purchasing a new car. It is noteworthy that a VAT of 24 percent is calculated based on the car's price with the car tax. The tax is looked up from Tax Administration's (2019b) table as a percent of car price and is based on the CO_2 emissions of the car. Since 2019, EVs have enjoyed the minimum tax rate of 2.7 percent compared to the maximum of 50 percent, and for reference the base model of the most sold car and most popular company car of 2019, Skoda Octavia, (Rönkkö, 2019, Autovouhotus, 2020) had a tax rate of 17.2 percent. The average and minimum tax rates have come down a few percent since 2016.

The Finnish vehicle tax is a yearly tax for owning a vehicle and is comprised of basic tax and tax on driving power (Traficom, 2019). The basic tax is determined by the CO_2 emissions and begins at 53.29€ per year at 0 g/km, maxes at 654.44€ per year at over 400 g/km and the reference Skoda at 121.54€ per year at 121 g/km. In addition, if the car is powered by something other than gasoline, the tax on driving power is also imposed based on the type of power source and car weight. EVs have the driving power tax of 5.475€/year/partial or complete 100 kg, diesel costs 20.075€/year/partial or complete 100 kg and petrol hybrids 1.825€/year/partial or complete 100 kg. For comparison, the Skoda Octavia in gasoline costs 186€ per year, 574€ per year in diesel (ŠKODA, 2019) and a comparable slightly cheaper and smaller Volkswagen e-up! EV costs 119€ per year (EV Database, n.d; Trafi, n.d.).

Finnish car benefit tax is paid by an individual when they have been given an employer provided vehicle for private use and is considered to be a part of taxable income (Tax Administration, 2020). There are two types of employer-provided vehicles: unlimited benefit, where the employer pays all expenses related to the car, such as the car itself, maintenance and fuel; and limited benefit which is similar, except that the employee pays for the fuel. Limited is cheaper if the employee does not drive too much and unlimited is the superior choice if the employee drives more. Only unlimited employer provided vehicles receive tax benefits from EVs, and therefore only the unlimited benefit tax will be examined. There are two ways to calculate the limited tax cost and the user is free to choose the cheaper option if the required paperwork is in place. Both include monthly a percent of the price of the car and either a flat fee or fee per kilometer driven. Vehicles are in different age groups, based on when they were put on roads, which determines the percent and fees.

Table 2 below provides the formula for calculating the Finnish car benefit tax for combustion engine cars. The individuals paying the tax can choose to use the cheaper formula for them with either flat fee or cents per kilometer. Cents per kilometer option requires the individual to upkeep a log of distances driven.

Age group	Year when put on road		Percent of the replacement price of the vehicle		Fee			Cents per km
A	2018-2020	Monthly value =	1.4	+	270	*OR*	+	18
B	2015-2017		1.2		285			19
C	Before 2015		0.9		300			20

Table 2 Finnish unlimited car benefit monthly taxation. (adopted from Tax Administration, 2020)

EVs are incentivized as unlimited employer provided cars as, if a vehicle is powered only by electricity, the user has to pay 120€ or 8 cents per km less per month. As can be seen from Table 2 and the EV price reductions, EVs noticeably cheaper. To compare, the popular for the Skoda, the receiver of the unlimited benefit has to pay at least 540€ per month for the almost 23 000€ car after taxes (ŠKODA, 2019) whereas a Volkswagen e-up! driving employee pays 430€ per month for the 21 500€ car after taxes, excluding special campaigns (K Auto, 2019).

Norway has very simple incentives to calculate compared to the convoluted schemes set up by the Finnish authorities, as most of the incentives are simply removing or cutting current car related taxes or fees. The taxes in turn seem to be even more complicated. In addition, traditional fuels are taxed heavily. The taxation of fuel is done by combining three taxes. The first is road tax on fuel, the second is mineral product tax and both are a flat fee for every liter of fuel, currently 11.08 NOK/liter combined, or around 1 €/liter for gasoline and 8.69 NOK/liter combined, or around 0.8 €/liter (The Norwegian Tax Administration, n.d.c; The Norwegian Tax Administration, n.d.b; xe, 2020, prices converted on 11.03.2020). Additionally, the third tax, VAT of 25%, is added to the after-tax cost of fuel. These taxes amount to a price for the consumer that has historically been similar but slightly higher than in Finland, and the price for a liter of gasoline has fluctuated between 1.5€ and 1.58€ since

December 2019 to March 2020 (GlobalPetrpPrices.com, 2019) compared to the Finnish prices between 1.49€ and 1.56€. Overall the differences in fuel price are insignificant.

The largest incentive is the complete exemption from purchase taxes, including the 25 percent VAT, on EVs. The Norwegian car purchase tax is composed of many parts and is very complicated, as shown in Figure 2 In addition to the Figure 2, greenhouse gas tax for air-conditioning/climate control systems is calculated according to the weight of the greenhouse gas for 778 NOK/kg and registration transfer fee must also be paid. Without going into further detail about exactly how the taxes are calculated, a good understanding of their effects can be seen from the comparison car, 2020 Skoda Octavia 1.0 TSI (115HP). In Norway, the retail price, including purchase taxes, is 305 900 Norwegian kroner (ŠKODA, 2020) or around 28 100 euros, compared to the Finnish 22 860 euros after taxes. While the standard features for the two cars may differ slightly, the comparison shows adequately how basic petrol cars are significantly more expensive in Norway than in Finland. However, due to the lack of purchase taxes, EVs are significantly cheaper. As an example, the Volkswagen e-up! (82HP) costs 191 300 Norwegian kroner (Harald A. Møller AS, 2020), or over 17 500 euros, while in Finland, the same car costs 21 500 euros excluding special campaigns (K Auto, 2019).

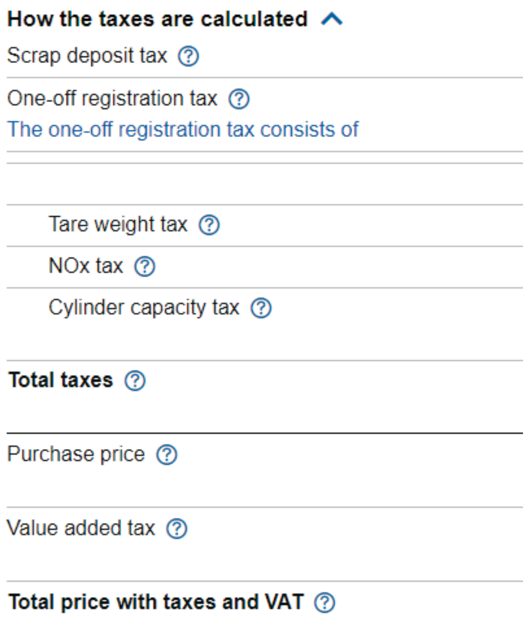

Figure 2 Norwegian car purchase taxes. The scrap deposit tax is 2400 NOK. (Adapted from The Norwegian Tax Administration, n.d.d)

EVs are also exempt from the Motor Insurance Tax (Elbil.no, n.d.) that, as of March of 2020, is 2 963.8 Norwegian kroner per year (Trafikkforsikringsavgift, n.d.), or around 270 euros. Before 2017 EVs were completely exempt from road tolls and ferry fares, and as of 2019 they can only be charged up to 50% of the total. These tolls can be quite expensive when driving often, as illustrated by Figure 3. Additionally, parking fares are restricted similarly and EVs with passengers can access bus lanes. The company car tax, which is somewhat similar to the Finnish car benefit tax, is reduced significantly by 40 percent, down from the former 50 percent, for EVs. The Norwegian Tax Administration states the company car tax to be the following:

Rates | New toll stations in Oslo and Akershus | Rates form June 1

Rates

The rates are without a discount. With an AutoPASS-agreement, vehicles in Rate group 1 get a 20% discount on all of the toll crossings, and get benefits, an hourly rate, and a monthly maximum price. Vehicles in Rate group 2 will not get a discount, but with an AutoPASS agreement the hourly fee and monthly maximum price will still apply.

Rate group 1

This rate group includes vehicles with an allowed total weight of 3.500 kg, and category M1 vehicles with an AutoPASS agreement.

Indre ring

Pay both ways	Gasoline/Rechargeable hybrid	Diesel	Electric car
Crossing	17 kr	19 kr	4 kr
Crossing (rush hour)	21 kr	23 kr	8 kr

Osloringen

Pay both ways	Gasoline/ Rechargeable hybrid	Diesel	Electric car
Crossing	21 kr	25 kr	5 kr
Crossing (rush hour)	28 kr	31 kr	10 kr

Bygrensen- Payment in to Oslo

Pay one way	Gasoline / rechargeable hybrid	Diesel	Electric car
Crossing	21 kr	25 kr	5 kr
Crossing (rush hour)	28 kr	31 kr	10 kr

Figure 2 Road tolls in Oslo and Akershus (Fjellinjen, n.d.)

> The benefit of private use of a company car is set to 30% of the car's list price as new, up to NOK 314,400 and 20 per cent of the excess list price.
>
> …
>
> In the case of electric cars the basis for the calculation is only 60 per cent of the car's list price as new. (Norwegian Tax Administration, n.d.a: Year 2020)

Norway being richer, and therefore able to afford tax exemptions for EVs, is often cited as the reason for the differences in adoption rates by many Finns. There is some truth to this claim when comparing the tax revenues from cars in both countries. According to Det Kongelige Finansdepartement (n.d.), Norway collected 24.9 billion NOK in 'Avgifter på motorvogner,' or taxes on motor vehicles, in 2018. This figure translates to around 2.18

billion euros (xe, 2020), or to about 790 euros per car on the road (Opplysningsrådet for veitrafikken, n.db). Meanwhile in Finland, the tax revenue from car purchase tax, vehicle tax, and VAT of new cars was around 3.09 billion euros in 2018, or 1 150 euros per car on the road (Autoalan tiedotuskeskus, 2019b; Traficom, 2019). While the figures might not be directly comparable, they indicate well the scale and how much revenue car taxes bring to both countries. The figures also indicate the Finland could not directly adopt the Norwegian incentive system, as it would likely lead to budget deficits.

In summary, the Finnish incentives for EVs are composed of a direct subsidy, reduced taxation and high fuel prices. In Norway the incentives are tax exemptions, reduced fees and ownership taxes in addition to better mobility in traffic while also discouraging combustion engine cars with even higher taxes and high fuel prices. Overall, the incentives in Norway for EV adopters either provide more utility, are less complicated, or when comparable, flat out better for adopters' wallets than Finland's incentives. Especially the purchase tax differences are massive. The base petrol car used in comparisons, Skoda Octavia, is almost 23 percent more expensive in Norway than in Finland, while the comparison EV, Volkswagen e-up! is over 18 percent cheaper in Norway than in Finland. In Finland, the two cars are direct competitors price wise, whereas in Norway the petrol car is about 60 percent more expensive than the EV, leaving little doubt on which car offers better value for money. As competitive EV prices were found to be very important for adoption in the literature review section, these price differences could explain the large majority of the differences in adoption rates between the two countries.

4.3. Comparison of Finnish and Norwegian environments

Differences in attitudes and general environment should be looked at to gain an understanding on how these factors could affect the adoption rates in Norway and Finland.

As green values have been found to be one of the best predictors to adopt EVs, the differences in general strength of those values between Norway and Finland could be used to explain different adoption rates. However, Luís, Vauclair and Lima (2018) found the difference in general environmental concern to be negligible, with Finland having 0.05 higher score on a scale of 0-5 than Norway's 3.42, opposite to what might be expected when explaining adoption rate differences through the concerns of citizens, as Norway has higher rates. This seemingly rebuffs the notion of adoption rate differences being due to more concerned citizens, but the study was not a standardized survey, favoring interviews, self-completion questionnaires and other various methods, making it somewhat inaccurate source if exact statistics are needed. These statistics support the notion that the differences in climate concerns and green values of the general population are not the reasons for the differences in adoption rates of EVs between the two Nordic countries that are examined.

Local climate can affect car selection and actual performance and characteristics. The climates of Norway and Finland are very similar with the largest difference being that Finland has larger temperature ranges as it is does not have as much ocean stabilizing the temperatures (weatheronline.co.uk, 2018; Finnish Meteorological Institute, 2010). Both countries have winters with snow and below freezing temperatures, with Finland having -20 degrees Celsius often during winters. As a result of the cold temperatures reducing battery range and salted roads corroding cars faster, both countries suffer from the same drawbacks in EV ownership. Therefore, the effect of climate can be considered negligible.

Norway is significantly wealthier than Finland with a GDP of 81 697.2 USD per capita, opposed to Finland's 50 152.3 USD per capita (Worldbank, 2018; Worldbank, 2010). and has significant public funds as a result of a strong economy, natural resources and good management of their proceeds. This means that Norway has significantly more resources to fund incentives programs for EVs. In addition, the average age of Finnish cars is over 15 percent higher than in Norway (Autoalan Tiedotuskeskus, 2020), leading to longer times for Finland to renew their car fleet, and further leading to fewer people adopting EVs in short term.

The populations of Finland and Norway are quite similar in Hofstede's country comparison, with the only difference in the masculinity-femininity scale, with Finnish score being 26 as opposed to the Norwegian score of 8 (Hofstede Insights, 2018). The more feminine society in Norway can explain to a small degree some of the differences in adoption, as "Femininity, stands for a preference for cooperation, modesty, caring for the weak and quality of life. Society at large is more consensus-oriented" (Hofstede Insights, n.d.). These values likely also predict stronger green values, which have been shown to be good predictors of adoption. However, it is unlikely that the masculinity differences have directly caused the differences in EV adoption rates but may have had an effect on the incentives schemes in both countries.

The age pyramids of both countries are similar, but Finland is slightly older in general, as seen in Figure 4 below. Norwegians being slightly younger, despite age being a somewhat weak indicator, can explain some of the adoption rate differences. Figure 4 shows the general shape of the age pyramids of both Finland on the left and Norway on the right.

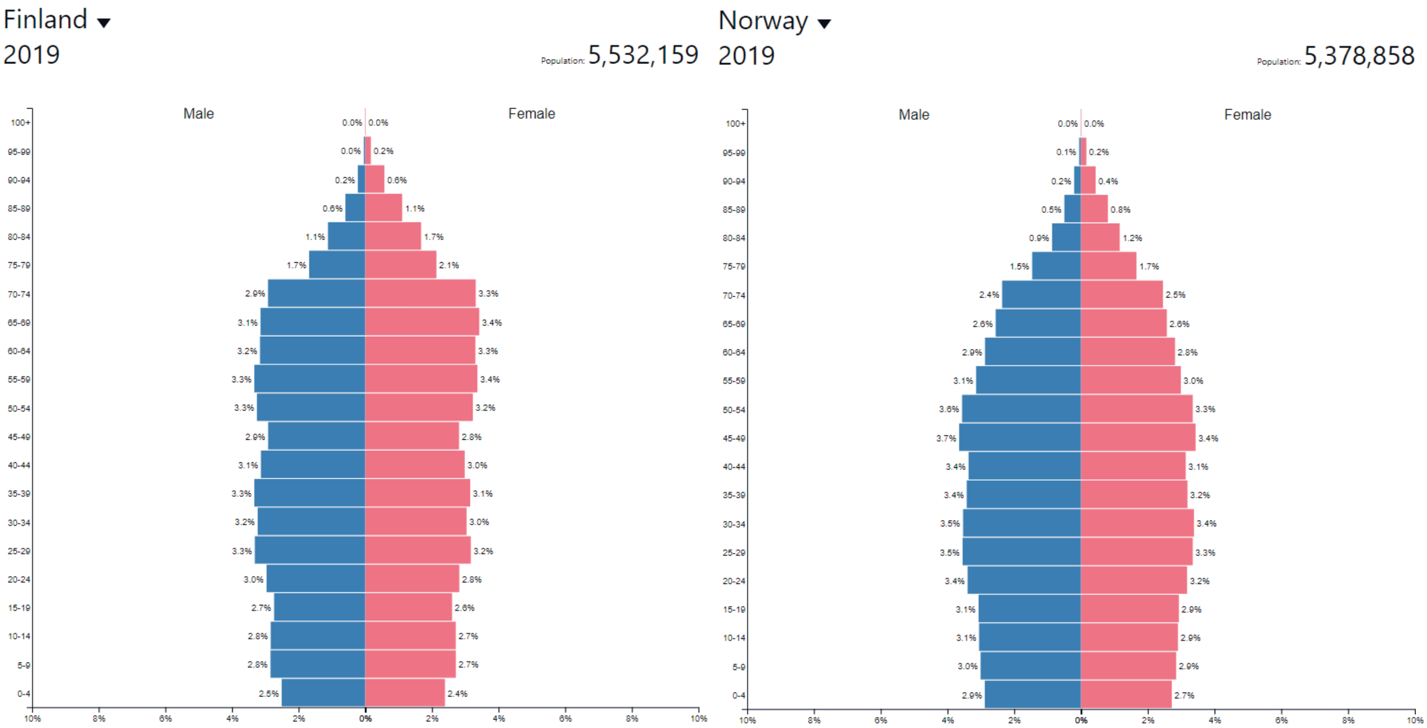

Figure 3: Age pyramids of Finland and Norway (PopulationPyramid.net 2019)

To conclude, Norway and Finland are very similar places in terms of populations and environment, with the only large differences being in wealth and average age of cars. More wealth allows car fleets to be renewed more often, leading to lower average age of cars, and allows authorities to run more incentive programs. Lower average age leads to more chances for a person to adopt an EV additionally. Therefore, the wealth difference, and to an extent policies that affect average car age, can be said to affect the difference between Norway and Finland in adoption rates.

4.4. Interview findings

The experts' stances were very uniform on most subjects, and their answers had the same base elements. On the other hand, the time spent discussing the base elements differed and the additional elements brought up were not all the same. Views or ideas brought up by only one of the experts were rare, and echoes of most of the additional elements that any expert mentioned could also be heard from other experts. The findings will be presented thematically, instead of discussing answers to each question individually, as often the same themes were found in multiple questions. These themes were price, incentives, infrastructure, technology, general knowledge about EVs, politics and interests, and early adoption and hybrid vehicles. Finally, other highlights are discussed. The topics will be covered in the order of relevancy, with the most relevant first.

4.4.1. Price

Without a doubt, purchase price rose up as the largest EV adoption affecting factor and was discussed by everyone. Most experts mentioned price multiple times and in similar contexts. All five Finnish experts named high EV prices as one of the largest barriers for adoption in Finland. In Norway, prices were never mentioned as a barrier, likely due to EVs being much cheaper in total and even cheaper when compared to traditional combustion engine cars. Lowered prices were cited often as having increased EV adoption and lowering the prices further was considered very important in increasing adoption rates further in Finland. One expert theorized that EVs will start overtaking the currently popular hybrid vehicles in Finland when the EVs have a range of hundreds of kilometers while costing around 40 000 to 35 000 euros, suggesting a sweet spot for EV pricing. Expert #2 (2020, Translated from Finnish) states: (original in Finnish, *translation in italics*)

> … kun päästään siihen vaiheeseen, että ladattavalla täyssähköautolla päästään satoja kilometrejä mutta samaan aikaan se maksaisi vaikka esimerkiksi 40 000 tai 35 000 euroa. Ennen kuin niitä malleja tulee enemmän, uskon että ladattavilla hybrideillä tulee ihmiset vielä jonkin aikaa enemmän ajelemaan. Mutta sitten kun varmaan hintapisteet rupeavat tulemaan alas suhteessa pitkiin ajorangeihin, siinä vaiheessa täyssähköautot painaa enemmän kaasua.
>
> *… when we reach the point where with a chargeable full EV we can drive hundreds of kilometers, but at the same time it would cost for example 40 000 or 35 000 euros. Before more of those models come, I believe that people will drive chargeable hybrids more for a while. But probably when price points start to come down in relation to long driving ranges, that's when full EVs step on the gas pedal.*

Coincidentally, this is the starting price range in Norway for the bestselling car, Tesla Model 3, an EV with a much longer range than 200 kilometers (Klesty & Karagiannopoulos, 2020).

4.4.2. Incentives

Closely related, government incentives were in a major role, and all but one considered them very important in both countries. Only one did not mention incentives but answered over e-mail and in very concise form. Three experts considered the incentives to have had a massive effect on high adoption rates in Norway and some mentioned it as the primary reason, and one mentioned the incentives benefitting EV sales the most.

> I think the most it's been about the policy [tax breaks in Norway]. ... The reason people bought the electric car was, it was a cheaper car to have and it's easy to maintain. (#1)

This would be in line with price being the most important factor, as the incentives remove the significant car tax, and the 25% VAT. Most considered the Finnish EV incentives to be important

> Mutta näkisin että nuo verohelpotukset kuluttajapuolella, ettei sinun tarvitse maksaa niin paljoa autoveroa, se on varmasti edistänyt sitä ja sama koskee yritysautojen puolella… (#2)

> *But I would see that those tax reliefs on the consumer side, that you don't have to pay so much car tax, it has forwarded it [EV sales] for sure and it is the same on the company car side… (#2)*

4.4.3. Existing infrastructure

In addition to the incentives, three experts named the construction of the existing charging infrastructure to have been vital for any significant adoption rates of EVs in both countries. One mentioned the lack of charging points as a current major barrier, but the issue of easy access to the charging stations was a concern for two experts. Currently there are multitudes of companies offering charging at their locations, and nearly all of them have their own phone apps or tags used for charging. This could make charging a hassle that people would rather avoid, as they would need to have to set up multiple apps or ID tags with payment details and always wonder about which app or tag is correct for the station they want to charge at. Currently there are solutions to this problem, as expert #5 (2020) states

> Sitten yksi asia mikä ihmisiä mietityttää on, että saanko sen lataukseen, mitä lataaminen maksaa ja missä latauspisteitä on. Tähänkin ongelmaan on ratkaisuja tuotu, eli löytyy erilaisia verkkoja ja appeja joista voi latauspisteitä ihmetellä.

One thing that confuses people, is if I can charge it [EV], what does the charging cost and where can I find charging points? Even for this problem, solutions have been brought up, there are different networks and apps from where one can wonder about charging points.

The other expert that mentioned the issue has spent much effort in the past with their business in removing this barrier and cooperates with the company behind one of the aforementioned apps. This app, Plugsurfing, gives locations, access and acts as a payment method for the customer to most charging stations across Europe through the app or an ID, removing most of the hassle in charging and making the process very easy. The emphasis on infrastructure in the past and the reduced emphasis currently suggests that achieving a base level of charging infrastructure is vital for large scale adoption but adding more stations starts facing diminishing returns when the number of stations rises much above sufficient levels.

4.4.4. Technology

New technologies were considered very important for adoption by five of the experts, but not often discussed in too much depth. Two different important technological factors were however brought up multiple times, and their effects were largely interlinked. One expert highlighted how young the modern EV industry is, and that there is still much room for growth.

Uudet teknologiat ovat erittäin tärkeitä. Muistetaan että sähköautoilu on vain 12-13 vuotta vanhaa bisnestä. Tämä on aika uutta ja nuorta vielä. Kehitys on ollut huimaa ja se jatkuu jatkamistaan vielä monta vuotta. Me olemme ihan sähköautoilun alussa vielä. (#4)

New technologies are extremely important. We should remember that EVs are only a 12 to 13-year-old business. This is quite new and young. Development has been wild and keeps on going for many years. We are still right in the beginning of EV usage. (#4)

The more important of the two technologies was improving battery technology that allows for more energy efficiency and therefore improved ranges in addition to all-important lower prices. The second important technological factor was improving mass production of EVs, driving the prices even lower.

> Nyt kaikki on puhunut siitä, että sähköautot ovat liian kalliita, koska akut ovat liian kalliita ja niin poispäin. Se on johdannainen siitä, että tuotantovolyymit ja -kapasiteetti on ollut vielä kehitteillä. (#4)
>
> *Now everyone has said that EVs are too expensive, because batteries are too expensive and so forth. It is due to production volumes and capacities still developing. (#4)*

Because price incentives and new technologies that specifically reduce prices are considered important to increase adoption to EVs, even more weight is placed upon the notion that EV prices are currently the most important factor, especially in Finland. Better driving characteristics and technological features of EVs were both mentioned once.

4.4.5. Knowledge and experience

Increasing general knowledge and experiences with EVs have a hand in increased adoption according to many experts. Two experts considered the lack of knowledge to have been a hinderance to EV adoption in the past in Finland, but considered that much of the doubts have vanished, while one still considers the lack of knowledge and other doubts regarding EVs to be a reducing factor. Two experts describe how attitudes and knowledge have changed in the following way:

> Radikaalisti. Aikaisemmin asennehan oli hyvin pidättyväinen ja kaikki puhuivat siitä, että ne ovat kalliita ja niin poispäin. Kun mallitarjonta lisääntyy ja tulee myöskin halvempia autoja, niin asenteet muuttuvat kummasti. (#4)
>
> *Radically. Earlier the attitude was very reserved, and everyone talked about how they [EVs] were expensive and so forth. When model offerings increase and also cheaper cars come, then the attitudes 'oddly' change. (#4)*
>
> Ehkä se mollaava 'sähkövispilä' kirjoittelu on väistynyt. Se oli aikaisemmin mitä keskustelupalstoilla näkyi, tällaista turhaa vastakkainasettelua. (#5)
>
> *Maybe the insulting 'electric scooby-doo' writings have receded. It was seen before on internet forums, this kind of unnecessary confrontation. (#5)*

The theme of general knowledge and experiences having improved to current day and it affecting sales is also echoed in the interview of the only Norwegian. According to them, the sales process and tactics for EVs has changed significantly. Early on, test drives were extremely important and longer test periods were used to let the customer experience daily life with an EV, as they did not have much information and different incentives were used. Currently the process is very similar to traditional cars, where customers often already know about the car and the main marketing points are the technological features and payment options. Two knowledge sources came up often and the first was the positive experiences of neighbors and acquaintances. The other was test drives, considered by three experts to be very effective at destroying most prejudices. One Finnish expert stated this very clearly:

> Ja kun pääsee kokeilemaan ja ajamaan sähköautoa, sen jälkeenhän halua perinteiseen polttomoottoriautoon ei ole. (#4)
>
> *And when you get to try and drive an EV, after that the desire to go back to combustion engine cars does not exist (#4)*

4.4.6. Conflicting interests

Curiously, interests of different groups and politics played a large role in adoption. Two experts regarded the oil industry's power over fuel prices, lobbying and general opinion influencing to have largely damaged the EV industry. One of them considered it as one of the major EV adoption reducing factors:

> Ehkä tällainen polttoaineteollisuuden, propagandaksikin sitä voisi kutsua, erilaiset epäilystä herättävät ja tällaiset muut kannanotot ja tutkimukset. Ne pyrkivät kaikin tavoin säilyttämään olemassa olevan tilanteen. (#5)
>
> *Maybe these, which could be called as propaganda, different and other kinds of statements and research papers that raise suspicion [of EVs] by the fuel industry. They try to keep the status quo by any means.*

General world views of citizens that influence politics were considered to have influenced the differences in adoption at a fundamental level by three experts. Two of the experts had similar points, that the Norwegian political sentiment was to punish polluting car usage, or to cut transportation emissions to certain level. The third considered tax free EVs like in Norway to be impossible in Finland, due to prevailing Finnish "neighbor jealousy." Therefore, it would be a career ending mistake for many politicians to show clear favoritism to one option over all others, and in this case for EVs over traditional fuels. In the past in Finland people often put down EVs on internet forums and newspaper articles without clear reasons, as previously quoted, but such actions have reduced according to one expert, showing that the knowledge of EVs has increased and that in the past some political views reduced EV adoption. Articles and internet forums are important in shaping the opinions and perceptions of cars for some, and therefore one could theorize that the negative comments likely stopped some people from even considering an EV for a while.

4.4.7. Best courses of action

For Norway, the three experts that talked about the best course of action for Norway to increase EV adoption, all agreed that there were not any special actions, mainly to keep the current incentives, which shows the major success of the current incentive scheme. In Finland, two experts strongly brought up the same seemingly very effective idea of changing the company car taxations system, as companies have purchasing power, to one that is similar to Norway's to most effectively increase adoption:

> …annettaisiin tukea työsuhdeautoille, niin että päästöjen mukaan työsuhdeautojen verotusarvo kevenisi. Eli jos sinulla on hyvin vähäpäästöinen auto, saat puolet verotusarvosta anteeksi. Tämän nerokkuus on siinä, että yksittäiselle työsuhdeautoilijalle on hyvin merkittävä tuki, mutta valtion kannalta verrattuna joka ikiseen mahdolliseen muuhun tukimuotoon, se on hyvin marginaalinen. …työsuhdeautojen juttu on se, että ne keskimäärin palautuvat kolmessa vuodessa markkinoille käytettyinä autoina. Ja sitä kautta myöskin käytettyjen autojen markkinat alkaisivat nopeammin täyttymään vähäpäästöisistä autoista. (#3)
>
> *…give support to company cars [given to employees for personal use], so that based on emissions, the taxation value would reduce. So, if you have a very low emissions car, you get half of the tax waived. The genius in this is that for the individual company car user this is a major incentive, but for the government it is very marginal compared to every other incentive. …the thing with company cars is that, on average, they come back to the markets as used cars. And that way also the used car market would start to fill up faster with low emissions cars. (#3)*

4.4.8. Other findings

Earlier on those who bought EVs wanted EVs specifically, but as time has passed, especially in Norway, more and more regular people adopt EVs who might not have considered it earlier:

> What makes a potential electric car buyer? Everyone that has license to drive a car is a potential buyer. (#1)

Two experts were asked if hybrid vehicles represent a transition phase to EVs and both answered yes, and one other expert brought the same view up on their own, showing that EVs will likely be the future instead of hybrid vehicles. The Norwegian expert answered without a doubt that their business will solely be based on selling EVs, while most Finns guessed that EVs will be a large part, if not the majority of car business, and were hopeful that EVs might be the entire car business in Finland in the future. One could not give estimates, and one considered EVs to be a large part of the business in Europe in the future, but very small in developing countries. Specifically, they estimated followingly about their former company's future EV share of products

> Euroopassa sähköautot yleistyvät kaikkein nopeitten. …heillä [autonvalmistajalla] on oma tehdas Meksikossa mikä tekee paikallisille markkinoille edullisia pieniä autoja, ja ne auto eivät tule sähköistymään ihan lähivuosina ollenkaan. … Uskoisin että Euroopassa etenkin on merkittävä sähköautojen osuus. Globaalisti en näe, että sähköautot tulevat olemaan niin merkittävässä osassa. (#3)
>
> *In Europe EVs are becoming common the fastest. …they [a car manufacturer] have their own car plant in Mexico which manufactures budget friendly compact cars, and those cars will not become electric in the coming years at all. … I believe that especially in Europe the share of EVs is significant. Globally I can't see that EVs will be in a such a significant role. (#3)*

For other views brought up, one interesting way to increase adoption was "peer sharing" where the people or firms who own private charging points could sell charging from their points at a rate they choose. This idea would significantly improve the accessible infrastructure and provide use for both drivers and point owners through more charging locations and passive income. Two interviews pointed to the old Finnish car fleet as a barrier, and two complained about the lack of supply of EVs, both in numbers and models. One highlighted that the common misconception of Norway being able to afford subsidizing EVs more than Finland is wrong, as Norway covers the lost tax income from EVs by taxing traditional combustion engine cars even more to recover the lost tax revenue. Another expert thought that Norway had kept some of their subsidies too long, such as free charging, and that it may lead to problems. Few highlighted the new EU directive regarding the average emissions of a manufacturer's cars, and that it will bring a large change to the current EV adoption pace. The implications of the directive on this thesis will be discussed later in the limitations section.

4.4.9. Summary of interview findings

To summarize the findings of the interviews, price was the most important factor for EV adoption currently, and any technologies or incentives that reduce prices of EVs are similarly important. A base level of charging infrastructure is crucial for wide scale adoption, and the increase in general knowledge and experiences with EVs have removed the barriers of prejudice and doubt. While a good course of action for Norway is to keep the current incentives, for Finland any actions leading to EV price reductions, especially by taxation of company cars, are seen as important. Political and commercial interests, especially those of the oil industry, hinder development of EV markets. The interview results were quite uniform with each other and the previous sections of this thesis. The only strictly new finding from the interviews were the political and commercial interests, which are beyond the scope of this research.

When comparing the interviews to the desk research, no new major factors within the scope of the study came up. All in all, the results from both methods did not conflict with each other, but the interview results painted a much simpler picture: the main factor causing the differing adoption rates was purchase prices of EVs.

5. CONCLUSIONS AND DISCUSSION

5.1. Main findings

The purpose of this thesis was to find out the different reasons for the differences in EV adoption rates between Norway and Finland by answering the three research questions. The extent to which the current circumstances encourage adoption of EVs is quite different. While both countries discourage combustion engine cars and incentivize EVs, Norway incentivizes them to a much higher degree, with the most important incentive being complete exemptions from any purchase taxes. With this Norway has reached its goal of EVs being more economically favorable than the purchase of conventional cars. While Norway seems to have removed nearly all major barriers for individuals and companies to adopt electric vehicles, Finland struggles the most with the price of EVs. Most other barriers seem to be very small or negligible compared to high prices. Additionally, the views of experts on these subjects are very uniform. When contrasting the interviews to desk research, there were no contradictions, but the experts focused mainly on the price.

5.2. Implications for international business

As countries struggle to reign down pollution caused by transportation, many of them ought to seek ways to increase EV adoption together with clean energies. Implementing parts of the very successful Norwegian model, especially the prices, in countries with similar high car taxation could be relatively easy and very effective. Focusing on prices is the key for EV manufacturers seeking more sales in the Finnish markets, and for Norway's markets there are no simple answers.

The underlying reasons for the differences in incentive schemes between Norway and Finland are likely numerous. The most obvious of the reasons is the wealth difference between Norway and Finland. The Finnish tax revenue from cars is larger than Norway's, and Finland is unlikely to be able to afford to reduce the revenues to similar levels as Norway. However, it does not prevent Finland from following the same principle: reducing taxes for EVs while increasing taxes for traditional cars to compensate for the lost tax revenue. Another reason is likely politics. Not everyone in Finland agrees that EVs should be favored at the cost of traditional cars, and many wish for lower car taxes for all vehicles. It is not wise for a politician to increase car taxes and then show more favoritism for EVs like previously discussed, as it likely damages their reputation. Another reason could be ignorance about the positives and negatives of EVs and differing views about the need for individual countries to take action to reduce pollution and climate change. Especially in Finland many voters and politicians question the need to take action locally, as other countries pollute more or do not share goals as strict as Finland's. Additionally, Finland has not chosen a single vehicle power type to encourage to the fullest, like Norway did with EVs, but instead supports multiple alternative power types at the same time. This indecisiveness slows down adoption rates of alternative power types but may prove as a wise decision if other power types, such as hydrogen or biofuel powered cars, prove superior.

However, as EVs seem to be the best choice going forward from the current day, Finland should aim to increase the EV adoption rates. There are two very effective and relatively easy ways to increase EV sales that have been discussed before in this paper. The first, and the easiest, is to reduce significantly or even halve the tax paid by individuals for their company cars. This would encourage the adoption of EVs as company cars significantly, and as companies have significant buying power and company cars are resold after a short while, the results would be quickly visible. The second way would be to remove or reduce the VAT paid on EVs and increase taxes on gasoline and diesel cars to compensate lost tax revenue. Moving EVs from the current 24 percent VAT bracket to lower bracket, for example, the 10 percent bracket, would make EVs a significantly more lucrative purchase than a comparable gasoline car. Full tax exemptions would be the best choice for EVs, but do not seem feasible from the government budget perspective.

5.3. Limitations

This study is subject to multiple limitations. First off, this study sought to answer questions through factors and concepts, but not how much precisely these factors affect EV adoption, and therefore provided a general overview instead of concrete numbers and measurable causal relationships. The interview sample was very small, as only six interviews were conducted, and were subject to personal biases in choosing of questions, interview interactions and interview analysis. The questions were somewhat unfocused and overlapped a bit, and more time could have been spent developing them. The interviewee selection of the experts poses two factors that can skew the results. First one of these is the nationalities of the experts. While many of the experts had extensively worked in both Finnish and Norwegian EV markets, only one expert was Norwegian, and the rest were Finnish. The knowledge of Norwegian markets of said Finns was undeniable, but more information from the perspective of those operating solely in the Norwegian markets could have provided a better comparison to the views held by the Finnish. All but one of the interviewees were heavily invested in EVs. If not the most, then a large portion of their business was linked to EVs. As they are so heavily involved with EVs, their views may differ from those of traditional car industry experts. The EV experts have vast knowledge, but may be slightly biased in favor of EVs, while many traditional experts might have slightly less knowledge and differing views. To add to this issue, the four interviews gathered with the snowball method might not represent the view of most Finnish EV experts, as often people with similar views are favored in social and work contacts, or views became more similar through working in close contact.

In addition, much of the information in this thesis will be dated shortly, as the European Union created a new legislation that will place massive pressure on carmakers to push EVs like never before in the fear of massive fines and reduce the sale of traditional cars. European Commission (2016):

> From 2021, phased in from 2020, the EU fleet-wide average emission target for new cars will be 95 g CO_2/km.
>
> This emission level corresponds to a fuel consumption of around 4.1 l/100 km of petrol or 3.6 l/100 km of diesel.

Nevertheless, this study provides an in depth look into the factors that currently affect EV adoption, and how these factors have affected two countries with differing incentive schemes. It can be used as a base to for further study, especially into how the EU directive will affect the Finnish and Norwegian car markets, and to get a quite comprehensive snapshot of the situation before the directive.

5.4. Suggestions for further research

Much research has been done on EV adoption, but as car markets are very country specific, more quantitative research is needed on how much different factors affect EV adoption, preferably on country level. Research on what is an acceptable level of charging infrastructure would likely benefit the most in short term, as it seems to act as a foundation for widespread adoption. Additionally, research on the effects of the new EU legislation is needed.

6. REFERENCES

Aasen, M (2015) 'The polarization of public concern about climate change in Norway', *Climate Policy*, vol. 17, no. 2, pp. 213–230.

Anfinsen, M., Lagesen, V.A. and Ryghaug, M. (2019). Green and gendered? Cultural perspectives on the road towards electric vehicles in Norway. *Transportation Research Part D: Transport and Environment*, [online] 71, pp.37–46. Available at: https://www.sciencedirect.com/science/article/pii/S1361920918303092 [Accessed 30 Jan. 2020].

Autoalan Tiedotuskeskus (2020). *Average age of passenger cars in some European countries* [online] Available at: http://www.aut.fi/en/statistics/international_statistics/average_age_of_passenger_cars_in_some_european_countries [Accessed 8 Mar. 2020].

Autoalan tiedotuskeskus (2019b). Valtion verotulot tieliikenteestä (*State tax revenue from road transport*). [online] www.aut.fi. Available at: http://www.aut.fi/tilastot/verotus_ja_hintakehitys/valtion_verotulot_tieliikenteesta [Accessed 5 Apr. 2020].

Autoalan Tiedotuskeskus (2019a). Autojen keskihintatilastoja (*Average price statistics of cars*) [online] Available at: http://www.aut.fi/tilastot/verotus_ja_hintakehitys/autojen_keskihintatilastoja [Accessed 17 Mar. 2020].

Autovouhotus (2020), *Vuoden 2019 myydyimmät automallit – katso top 30* (2019's most sold car models - see top 30), https://autovouhotus.fi/vuoden-2019-myydyimmat-automallit-katso-top-30/ [Accessed 17 Mar. 2020].

Balzhäuser, S (2019*) EV and EV Charger Incentives in Europe: A Complete Guide for Businesses and Individuals* https://wallbox.com/en_us/guide-to-ev-incentives-europe#Finland [Accessed 17 Mar. 2020].

Barbarossa, C., Beckmann, S.C., De Pelsmacker, P., Moons, I. and Gwozdz, W. (2015). A self-identity based model of electric car adoption intention: A cross-cultural comparative study. *Journal of Environmental Psychology*, [online] 42, pp.149–160. Available at: https://www.sciencedirect.com/science/article/pii/S0272494415000304 [Accessed 26 Aug. 2019].

Bilsalget i 2018 (Car sales in 2018) n.d., Opplysningsrådet for veitrafikken, https://ofv.no/bilsalget/bilsalget-i-2018 [Accessed 17 Mar. 2020].

Bjerkan, K.Y., Nørbech, T.E. and Nordtømme, M.E. (2016). Incentives for promoting Battery Electric Vehicle (BEV) adoption in Norway. *Transportation Research Part D: Transport and Environment*, [online] 43, pp.169–180. Available at: https://www.sciencedirect.com/science/article/pii/S1361920915002126 [Accessed 24 Jun. 2019].

Brase, G.L. (2018). What Would It Take to Get You into an Electric Car? Consumer Perceptions and Decision Making about Electric Vehicles. The Journal of Psychology, 153(2), pp.214–236.

c2es.org. (2018). *Global Emissions | Center for Climate and Energy Solutions*. [online] Available at: https://www.c2es.org/content/international-emissions/ [Accessed 12 Feb. 2020].

Canals Casals, L., Martinez-Laserna, E., Amante García, B. and Nieto, N. (2016). Sustainability analysis of the electric vehicle use in Europe for CO2 emissions reduction. *Journal of Cleaner Production*, 127, pp.425–437.

Cherubini, S., Iasevoli, G. and Michelini, L. (2015). Product-service systems in the electric car industry: critical success factors in marketing. *Journal of Cleaner Production*, 97, pp.40–49.

Det Kongelige Finansdepartement (n.d.). Faktaark (*Fact Sheet*). [online] Available at: https://www.regjeringen.no/contentassets/62bcdd722d344cd0ac6b5361471f825c/faktaark_inntekter_utgifter.pdf [Accessed 5 Apr. 2020].

Ilmatieteenlaitos.fi (n.d) *Climate elements - Finnish Meteorological Institute 2010*, https://en.ilmatieteenlaitos.fi/climate-elements [Accessed 17 Mar. 2020].

Weatheronline.co.uk (2018), *Climate of the World: Norway | weatheronline.co.uk* https://www.weatheronline.co.uk/reports/climate/Norway.htm [Accessed 17 Mar. 2020].

Cotton-Barratt, O., Farquhar, S., Halstead, J., Schubert, S. and Snyder-Beattie, A. (2016). *Global Catastrophic Risks 2016*. [online] https://globalchallenges.org/. Global Challenges Foundation. Available at: https://globalchallenges.org/wp-content/uploads/2019/07/Global-Catastrophic-Risk-Annual-Report-2016.pdf [Accessed 12 Feb. 2020].

ec.europa.eu. (2019). *The European Union, Iceland and Norway agree to deepen their cooperation in climate action*. [online] Available at: https://ec.europa.eu/clima/news/european-union-iceland-and-norway-agree-deepen-their-cooperation-climate-action_en [Accessed 1 Mar. 2020].

Egbue, O. and Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy*, 48, pp.717–729.
Elbil.no (n.d.). *Norwegian EV policy*. [online] Available at: https://elbil.no/english/norwegian-ev-policy/ [Accessed 11 Mar. 2020].

Electrek (2019). *Watch Tesla Supercharger V3 add 100 miles of range in 7 minutes* - Electrek. [online] Electrek. Available at: https://electrek.co/2019/07/02/tesla-supercharger-v3-range-minutes/ [Accessed 1 Feb. 2020].

European Automobile Manufacturers Association (2018). Size & Distribution of Vehicle Fleet. [online] Available at: https://www.acea.be/statistics/tag/category/size-distribution-of-vehicle-fleet [Accessed 13 Feb. 2020].

European Commission (2019). *The European Union, Iceland and Norway agree to deepen their cooperation in climate action* [online] Available at: https://ec.europa.eu/clima/news/european-union-iceland-and-norway-agree-deepen-their-cooperation-climate-action_en [Accessed 17 Mar. 2020].

European Commission (2016). *Reducing CO2 emissions from passenger cars*. [online] Available at: https://ec.europa.eu/clima/policies/transport/vehicles/cars_en [Accessed 21 Mar. 2020].

European Parliament (2019). *CO2 emissions from cars: facts and figures (infographics)* | News | European Parliament. [online] Europa.eu. Available at: https://www.europarl.europa.eu/news/en/headlines/society/20190313STO31218/co2-emissions-from-cars-facts-and-figures-infographics [Accessed 12 Feb. 2020]

EV Database (n.d.). *Volkswagen e-Up!* [online] Available at: https://ev-database.org/car/1081/Volkswagen-e-Up [Accessed 10 Mar. 2020].

Figenbaum, E., Kolbenstvedt, M. and Elvebakk, B. (2014). *Electric Vehicles – environmental, economic and practical aspects. As seen by current and potential users*. [online] Transportøkonomisk institutt. Available at: https://www.toi.no/publications/electric-vehicles-environmental-economic-and-practical-aspects-as-seen-by-current-and-potential-users-article32644-29.html [Accessed 31 Jan. 2020].

Finland. Tax Administration (2019a) *Tax rates on liquid fuels* (11. Nov)

Finland. Tax Administration (2019b) *Ajoneuvojen veroprosentit* (Tax percents of vehicles) (1. Jan)

Finland. Tax Administration (2020) *In-Kind Benefits* (Fringe Benefits) 2020

Finland. Traficom Statistics database (2019) *Vehicles in traffic by quarter in 2008 to 2019 and First registrations of passenger cars in 2016 to 2020*

Fjellinjen (n.d.). *New toll stations in Oslo and Akershus - Rates form June 1*. [online] Available at: https://www.fjellinjen.no/private/prices/new-toll-stations-in-oslo-and-akershus/rates-form-june-1/ [Accessed 11 Mar. 2020].

Center for Climate and Energy Solutions (2018), *Global Emissions* c2es.org, Center for Climate and Energy Solutions, viewed 12 February 2020, https://www.c2es.org/content/international-emissions/

GlobalPetrpPrices.com (2019). *Norway gasoline prices, 25-Nov-2019* | GlobalPetrolPrices.com. [online] Available at: https://www.globalpetrolprices.com/Norway/gasoline_prices/ [Accessed 11 Mar. 2020].

Hall, D. and Lutsey, N. (2018). *Effects of battery manufacturing on electric vehicle life-cycle greenhouse gas emissions*. The International Council On Clean Transportation.

Harald A. Møller AS (2020) *Volkswagen e-up!*

Hofstede Insights (2018). *Compare countries* - Hofstede Insights. [online] Available at: https://www.hofstede-insights.com/product/compare-countries/ [Accessed 16 Mar. 2020].

Hofstede Insights (n.d.). *National Culture.* [online] Available at: https://hi.hofstede-insights.com/national-culture [Accessed 16 Mar. 2020].

IEA, (2019). *Global EV Outlook 2019*. [online] Available at: https://www.iea.org/reports/global-ev-outlook-2019#key-findings [Accessed 13 Feb. 2020].

Guo, D. and Zhou, C. (2016). Potential performance analysis and future trend prediction of electric vehicle with V2G/V2H/V2B capability. *AIMS Energy*, [online] 4(2), pp.331–346.

Available at: https://www.aimspress.com/fileOther/PDF/energy/energy-04-00331.pdf [Accessed 3 Apr. 2020].

Helmers, E., Dietz, J. and Hartard, S. (2015). Electric car life cycle assessment based on real-world mileage and the electric conversion scenario. *The International Journal of Life Cycle Assessment*, 22(1), pp.15–30.

Ilmatieteenlaitos.fi. (2010). *Climate elements* - Finnish Meteorological Institute. [online] Available at: https://en.ilmatieteenlaitos.fi/climate-elements [Accessed 2 Dec. 2019].

Internationalcomparisons.org. (2016*). International Comparisons: Transportation Statistics by Country*. [online] Available at: http://internationalcomparisons.org/environment/transportation.html [Accessed 31 Jan. 2020].

Jääskeläinen, S. (2017). *Alternative transport fuels infrastructure Finland's National Plan*. [online] Ministry of Transport and Communications. Available at: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80230/Report%205-2017.pdf?sequence=1&isAllowed=y [Accessed 1 Mar. 2020].

Jansson, J., Nordlund, A. and Westin, K. (2017). Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden*. Journal of Cleaner Production,* 154, pp.176–187.

K Auto (2019) *e-up! Hinnasto* (e-up! Prices)

Kester, J., Noel, L., Zarazua de Rubens, G. and Sovacool, B.K. (2018). Policy mechanisms to accelerate electric vehicle adoption: A qualitative review from the Nordic region. *Renewable and Sustainable Energy Reviews*, 94, pp.719–731.

Klesty, V. and Karagiannopoulos, L. (2020). After Tesla's record year in Norway, rivals gear up for 2020. *Reuters*. [online] 3 Jan. Available at: https://www.reuters.com/article/us-autoselectric-norway/after-teslas-record-year-in-norway-rivals-gear-up-for-2020-idUSKBN1Z20QQ [Accessed 14 Mar. 2020].

Langbroek, J.H.M., Franklin, J.P. and Susilo, Y.O. (2016). The effect of policy incentives on electric vehicle adoption. *Energy Policy*, [online] 94, pp.94–103. Available at: https://www.sciencedirect.com/science/article/pii/S0301421516301550 [Accessed 31 Jan. 2020].

Larson, P.D., Viáfara, J., Parsons, R.V. and Elias, A. (2014). Consumer attitudes about electric cars: Pricing analysis and policy implications. *Transportation Research Part A: Policy and Practice,* [online] 69, pp.299–314. Available at: https://www.sciencedirect.com/science/article/pii/S0965856414002134 [Accessed 25 Mar. 2019].

Lebeau, K., Mierlo, J.V., Lebeau, P., Mairesse, O. and Macharis, C. (2013). Consumer attitudes towards battery electric vehicles: a large-scale survey. *International Journal of Electric and Hybrid Vehicles*, 5(1), p.28.

LIU, Z., WU, Q., CHRISTENSEN, L., RAUTIAINEN, A. and XUE, Y. (2015). Driving pattern analysis of Nordic region based on National Travel Surveys for electric vehicle integration. *Journal of Modern Power Systems and Clean Energy*, 3(2), pp.180–189.

Luís, S., Vauclair, C.-M. and Lima, M.L. (2018). Raising awareness of climate change causes? Cross-national evidence for the normalization of societal risk perception of climate change. *Environmental Science & Policy*, 80, pp.74–81.

Mann, M.E. (2019). *greenhouse gas | Definition, Emissions, & Greenhouse Effect.* In: Encyclopædia Britannica. [online] Available at: https://www.britannica.com/science/greenhouse-gas. [Accessed 13 Feb. 2020].

Maric, P. (2019). *How long does it take to charge an electric vehicle? How does an EV charge? Plus our EV glossary*. [online] CarAdvice.com. Available at:

https://www.caradvice.com.au/743306/how-long-does-it-take-to-charge-an-electric-vehicle-how-does-an-ev-charge-plus-our-ev-glossary/ [Accessed 11 Feb. 2020].

MarketLine Industry Profile Hybrid & Electric Cars in Norway. (2019). MarketLine.

Mattar, S., Ansari, S. and Al-Madni, H. (2018). *Conceptualizing a Decision Making Process Model Around Aspects Influencing Consumers Considering Purchase of Electric Vehicles.*

Melliger, M.A., van Vliet, O.P.R. and Liimatainen, H. (2018). Anxiety vs reality – Sufficiency of battery electric vehicle range in Switzerland and Finland. *Transportation Research Part D: Transport and Environment*, [online] 65, pp.101–115. Available at: https://www.sciencedirect.com/science/article/pii/S1361920917310295 [Accessed 27 Nov. 2019].

Mersky, A.C., Sprei, F., Samaras, C. and Qian, Z. (Sean) (2016). Effectiveness of incentives on electric vehicle adoption in Norway. *Transportation Research Part D: Transport and Environment,* 46, pp.56–68.

METELINEN, S. (2019). ELÄMÄNMUUTOKSEN EMPIJÄT. [online] EVA. Available at: https://www.eva.fi/wp-content/uploads/2019/06/eva_analyysi_no_73-5.pdf [Accessed 2 Feb. 2020].

Moons, I. and De Pelsmacker, P. (2012). Emotions as determinants of electric car usage intention. *Journal of Marketing Management*, 28(3–4), pp.195–237.

mylpg.eu (n.d.a). *Chart of fuel prices in Finland*. [online] Available at: https://www.mylpg.eu/stations/finland/prices [Accessed 8 Mar. 2020a].

Nayum, A., Klöckner, C.A. and Mehmetoglu, M. (2016). Comparison of socio-psychological characteristics of conventional and battery electric car buyers. *Travel Behaviour and Society*, 3, pp.8–20.

Nissan Global Newsroom (2019). Nissan LEAF first electric car to pass 400,000 sales. [online] Available at: https://global.nissannews.com/en/releases/nissan-leaf-first-electric-car-to-pass-400k-sales?source=nng&lang=en-US&rss [Accessed 13 Feb. 2020].

Nordelöf, A., Messagie, M., Tillman, A.-M., Söderman, M.L. and Van Mierlo, J. (2015). Erratum to: Environmental impacts of hybrid, plug-in hybrid, and battery electric vehicles—what can we learn from life cycle assessment? *The International Journal of Life Cycle Assessment*, 21(1), pp.134–135.

Norway. Statistics Norway Statbank (2019) *07849: Registered vehicles, by type of transport and type of fuel (M) 2008 – 2018*

Norwegian Ministry of Transport and Communications (2017). *National Transport Plan 2018–2029*. [online] Norwegian Ministry of Transport and Communications. Available at: https://www.regjeringen.no/contentassets/7c52fd2938ca42209e4286fe86bb28bd/en-gb/pdfs/stm201620170033000engpdfs.pdf [Accessed 1 Mar. 2020].

Opplysningsrådet for veitrafikken (n.d.a). Bilsalget i 2018 (Car sales in 2018). [online] Available at: https://ofv.no/bilsalget/bilsalget-i-2018 [Accessed 8 Mar. 2020].

Orlov, A. and Kallbekken, S. (2019). The impact of consumer attitudes towards energy efficiency on car choice: Survey results from Norway. *Journal of Cleaner Production*, [online] 214, pp.816–822. Available at: https://www.sciencedirect.com/science/article/pii/S0959652618340575 [Accessed 10 Apr. 2019].

Pahurkar, R.N. and Metha, P. (2017). Developing Sustainable Marketing Strategy for Electric Vehicle (EV) -Automotif. *International Journal of Emerging Research in Management &Technology*, 6(11).

Pearre, N.S., Kempton, W., Guensler, R.L. and Elango, V.V. (2011). Electric vehicles: How much range is required for a day's driving? *Transportation Research Part C: Emerging Technologies*, 19(6), pp.1171–1184.

Peters, A.M., van der Werff, E. and Steg, L. (2018). Beyond purchasing: Electric vehicle adoption motivation and consistent sustainable energy behaviour in The Netherlands. *Energy Research & Social Science*, 39, pp.234–247.
PopulationPyramid.net (2019). Population Pyramids of the World from 1950 to 2100. [online] Available at: https://www.populationpyramid.net/ [Accessed 13 Feb. 2020].

Rolim, C., Baptista, P., Farias, T. and Rodrigues, Ó. (2014). Electric vehicle adopters in Lisbon: motivation, utilization patterns and environmental impacts. *EJTIR Issue*, [online] 14(3), pp.229–243. Available at: https://d1rkab7tlqy5f1.cloudfront.net/TBM/Over%20faculteit/Afdelingen/Engineering%20Systems%20and%20Services/EJTIR/Back%20issues/14.3/2014_03_03%20Electric%20vehicle%20adopters%20in%20Lisbon.pdf [Accessed 30 Jan. 2020].

Rönkkö, P.J. (2019). *Skoda on Suomen suosituin virkapirssi: Yksi merkki kiinnostaisi käyttäjiä vielä enemmän* (Skoda is Finland’s most popular company car: One brand would interest users more) [online] Available at: https://www.iltalehti.fi/autouutiset/a/8eb5378d-a111-4261-aee3-d02df32e3172 [Accessed 9 Mar. 2020].

Sierzchula, W., Bakker, S., Maat, K. and van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy*, [online] 68, pp.183–194. Available at: https://www.sciencedirect.com/science/article/pii/S0301421514000822 [Accessed 9 Apr. 2019].

Simsekoglu, Ö. (2018). Socio-demographic characteristics, psychological factors and knowledge related to electric car use: A comparison between electric and conventional car drivers. *Transport Policy*, 72, pp.180–186.

Simsekoglu, Ö. and Nayum, A. (2019). Predictors of intention to buy a battery electric vehicle among conventional car drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, [online] 60, pp.1–10. Available at:

https://www.sciencedirect.com/science/article/pii/S136984781830055X [Accessed 27 Nov. 2019].

ŠKODA (2019) *ŠKODA OCTAVIA VM2020-hinnasto – WLTP* (ŠKODA OCTAVIA VM2020-prices – WLTP)

ŠKODA (2020) *Prisliste ŠKODA OCTAVIA 2020-modell* (Pricelist for ŠKODA OCTAVIA 2020-model)

Sovacool, B.K., Kester, J., Noel, L. and de Rubens, G.Z. (2018). The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region. Global Environmental Change, [online] 52, pp.86–100. Available at: https://www.sciencedirect.com/science/article/pii/S095937801830030X [Accessed 11 Dec. 2019].

Tesla (2012). *Tesla Motors to Begin Customer Deliveries of Model S on June 22nd*. [online] Available at: https://www.tesla.com/blog/tesla-motors-begin-customer-deliveries-model-s-june-22nd?redirect=no [Accessed 17 Mar. 2020].

Un-Noor, F., Padmanaban, S., Mihet-Popa, L., Mollah, M. and Hossain, E. (2017). A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development. *Energies*, 10(8), p.1217.

The Norwegian Tax Administration (n.d.d). *Calculate what it will cost to import a car to Norway.* [online] Available at: https://www.skatteetaten.no/en/person/duties/cars-and-other-vehicles/importing/calculate/ [Accessed 11 Mar. 2020a].

The Norwegian Tax Administration (n.d.a). *Car rates - company cars*. [online] Available at: https://www.skatteetaten.no/en/rates/car-rates---company-cars/ [Accessed 11 Mar. 2020b].

The Norwegian Tax Administration (n.d.c). *Mineral product tax*. [online] Available at: https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/mineral-product/ [Accessed 11 Mar. 2020c].

The Norwegian Tax Administration (n.d.b). *Road tax on fuel*. [online] Available at: https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/road-tax-on-fuel/ [Accessed 11 Mar. 2020d].

Trafi (n.d.). *Laskurit - Ajoneuvoverolaskurit*. [online] Available at: https://laskurit.trafi.fi/ajoneuvoverolaskurit [Accessed 10 Mar. 2020].

Traficom (2019). *Structure and quantity of vehicle tax*. [online] Available at: https://www.traficom.fi/en/transport/road/structure-and-quantity-vehicle-tax [Accessed 10 Mar. 2020]

Traficom (n.d.). *Purchase subsidy for electric cars*. [online] Available at: https://www.traficom.fi/en/services/purchase-subsidy-electric-cars [Accessed 9 Mar. 2020].

Trafikkforsikringsavgift (n.d.). *Motor Insurance tax*. [online] Available at: https://www.tff.no/kjoretoy/trafikkforsikringsavgift/ [Accessed 11 Mar. 2020].

Valtiovarainministeriö (n.d.). *Value Added Tax*. [online] Available at: https://vm.fi/en/value-added-tax [Accessed 14 Mar. 2020].

Virta.global. (2019). *The Global Electric Vehicle Market In 2019* – Virta. [online] Available at: https://www.virta.global/global-electric-vehicle-market. [Accessed 11 Mar. 2020].

Wang, N., Pan, H. and Zheng, W. (2017). Assessment of the incentives on electric vehicle promotion in China. *Transportation Research Part A: Policy and Practice*, 101, pp.177–189.

Weatheronline.co.uk. (2018). *Climate of the World: Norway* | weatheronline.co.uk. [online] Available at: https://www.weatheronline.co.uk/reports/climate/Norway.htm [Accessed 1 Feb. 2020].

WHO (2019). *Ten threats to global health in 2019*. [online] Available at: https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019 [Accessed 12 Feb. 2020].

Wikipedia Contributors (2019). *List of electric cars currently available*. [online] Wikipedia. Available at: https://en.wikipedia.org/wiki/List_of_electric_cars_currently_available [Accessed 31 Jan. 2020].

Worldbank.org. (2010). *GDP per capita (current US$) - Finland | Data*. [online] Available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2018&locations=FI&start=2005 [Accessed 1 Feb. 2020].

World Economic Forum. (2019). [online] *World Economic Forum. Geneva: World Economic Forum*. Available at: http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf [Accessed 12 Feb. 2020].

Worldbank.org. (2018). *GDP per capita (current US$) - Norway | Data.* [online] Available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2018&locations=NO&start=2005 [Accessed 1 Feb. 2020].

Statistics Finland (2019). *Greenhouse gases.* [online] Available at: https://www.stat.fi/til/khki/2018/khki_2018_2019-05-23_tie_001_en.html [Accessed 7 Mar. 2020].

de Souza, L.L.P., Lora, E.E.S., Palacio, J.C.E., Rocha, M.H., Renó, M.L.G. and Venturini, O.J. (2018). Comparative environmental life cycle assessment of conventional vehicles with different fuel options, plug-in hybrid and electric vehicles for a sustainable transportation system in Brazil. *Journal of Cleaner Production*, 203, pp.444–468.

xe (2020). *NOK to EUR | Convert Norwegian Kroner to Euros* | XE. [online] Available at: https://www.xe.com/currencyconverter/convert/?Amount=8.69&From=NOK&To=EUR [Accessed 11 Mar. 2020].

Zap-Map. (2019). *EV Charging connectors - Electric car charging speeds*. [online] Available at: https://www.zap-map.com/charge-points/connectors-speeds/ [Accessed 11 Feb. 2020].

7. APPENDICES

Appendix 1: Interview question sets

Set 1

What makes a potential electric car buyer? Have they often already decided to get an electric car, or can normal car shoppers be made interested about electric cars?

In what special ways do you promote electric cars or why do you not?

What factors have benefitted the sales of electric cars the most (new technologies, government policies) and what factors in your opinion would make electric cars more attractive?

What factors limit the sales of electric cars?

How large portion of your business would you think electric cars will be in the future?

Set 2

What is your assessment of the current situation of EV markets in Finland and Norway?

What factors advance the usage of EVs and what factors limit it in Finland and Norway?

What is the role and importance of tech and incentives in Finland and Norway?

Are PHEVS transitional or the end product?

How have attitudes changed in the last 10 years and why in Finland and Norway?